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MAINTENANCE SERVICE MANUAL FTC-2003

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FOREWORD

The purpose of this manual is to provide information critical to the long-term operation and maintenance of the FTC-2003 VHF FM Hand-Held Transceiver. In the interest of clarity, descriptions have been kept brief, somewhat informal, while photographs and drawings are utilized liberally.

We believe the material presented herein to be correct and factual. However, should typographical or other errors be present, Yaesu assumes no liability for damage resulting from such errors. Your cooperation in pointing out any inconsistencies in the technical information would be appreciated.

The rugged, straightforward design of the FTC-2003 makes it likely that you will seldom have recourse to this manual. We hope and trust, however, that the material to follow will satisfy your requirements.

Your attention to the note below is requested.

C.H. Margelli, K7JA
Public Relations Manager
Yaesu Musen Company, Ltd.
Tokyo

IMPORTANT NOTE

Any adjustments to the FTC-2003 which affect the transmitter characteristics or operating frequency must be performed only by an FCC licensed technician holding a Second Class (or higher) certificate.

In countries other than the United States, please observe the pertinent regulations regarding licensing of service personnel.

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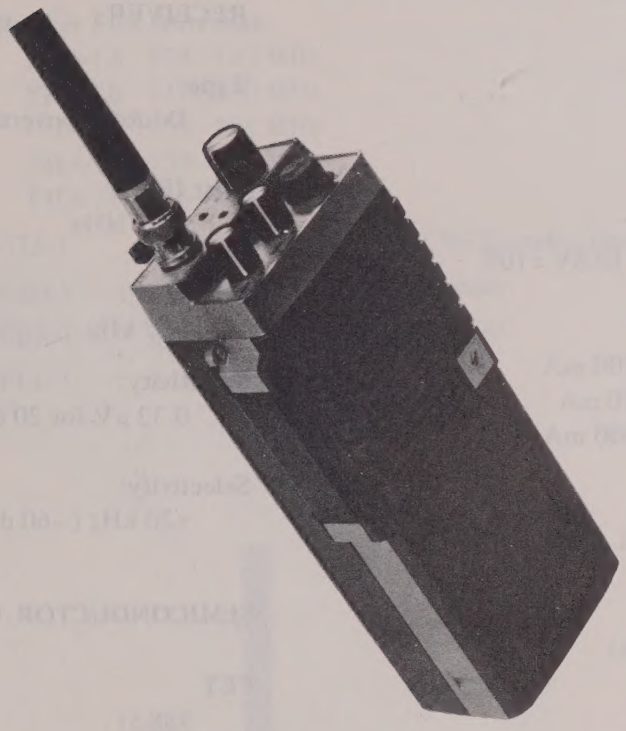
YAESU
FTC-2003 VHF FM
HAND-HELD TRANSCEIVER



GENERAL DESCRIPTION

The Yaesu model FTC-2003 is a high performance, compact VHF FM transceiver for portable applications. Designed for operation within any 4 MHz range of the 134–174 MHz land mobile band, the FTC-2003 features 3 watts of RF output and a flexible, quick-connect rubber flex antenna. The FTC-2003 weighs less than a pound, less batteries, and a full line of accessories is available for special applications.

Originally available with three channel capability, the FTC-2003 is now available with capacity for up to six channels. Audio quality, on both transmit and receive, is exceptionally clean and crisp, and the straightforward internal design reduces service time tremendously. With proper care and maintenance, the FTC-2003 will provide many years of reliable operation.

SPECIFICATIONS

GENERAL

Frequency Coverage:
134.00 MHz – 174.00 MHz
(All channels within 4 MHz range)

Number of Channels:
6

Operating Mode:
F3

Power Source:
NiCd Battery Pack @ 10.8V ±10%

Power Consumption:

Receive	200 mA
Receive (SQL)	20 mA
Transmit	800 mA

Case Size:
69 (H) x 49 (W) x 171 (D) mm

Weight:
650 g (w/battery pack)

TRANSMITTER

Power Output:
3.0 Watts

Modulation:
Vector Phase Modulation

Frequency Multiplication:
x 12

Deviation:
±5 kHz

Maximum Bandwidth:
16 kHz

Spurious Emission:
–50 dB or Better

Output Impedance:
50 Ohms

Microphone:
Electro-Condenser

Transmitter Stability:
Within 5 ppm.

RECEIVER

Type:
Double Conversion Superheterodyne

First IF:
10.7 MHz

Second IF:
455 kHz

Sensitivity:
0.32 μV for 20 dB QS

Selectivity:
±20 kHz (–60 dB)

SEMICONDUCTOR COMPLEMENT

FET

3SK51	1	JF1033B	2

Transistors

2SA695D	4	2SC1311E	14
2SC710D	2	2SC1923O	4
MRF237	1	MRF515	1
2SC1209D	2	2SC1815Y	2

Silicon Diodes

1S1555	5	MI301	1

Germanium Diodes

1S188FM	2

Zener Diodes

WZ050	1	WZ061	1

LED

LN28RP	2

Design and specifications subject to change without notice.

ACCESSORIES AND OPTIONS

YM-24	Remote Speaker/Microphone
NC-1A	Standard Battery Charger
NC-2	Quick Charger/AC Adapter
FNB-1	NiCd Battery Pack

Rubber Flex Antennas:

FHA-1A	134–142 MHz
FHA-1B	142–150 MHz
FHA-1C	150–158 MHz
FHA-1D	158–166 MHz
FHA-1E	166–174 MHz

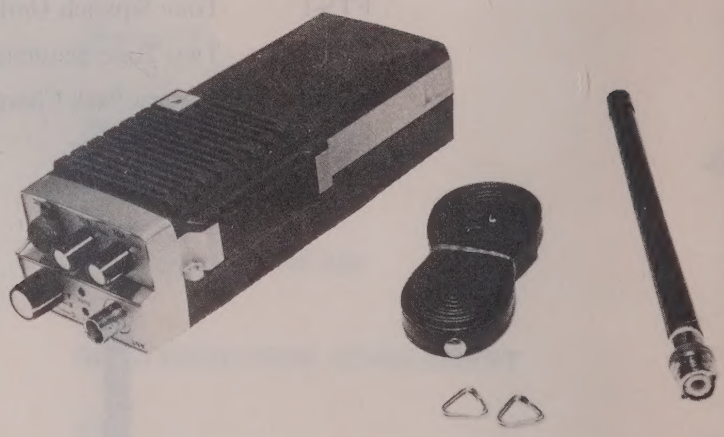
FTS-1	Tone Squelch Unit (CTCSS Encoder/Decoder)
F2D-1	Two-Tone Sequential Decoder
FBA-1	Battery Pack Charger Adapter
FLC-1	Leather Case

FTC-2003 + NC-2 Quick Charger/AC Adapter

INSTALLATION

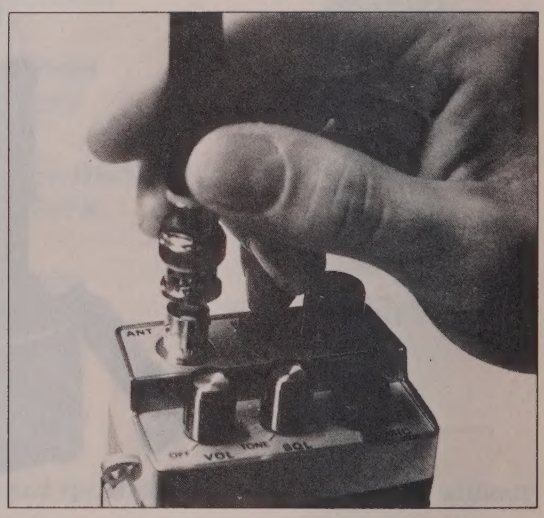
UNPACKING AND INSPECTION

When you first open the FTC-2003 packing carton, check the radio for any visible signs of damage. Before installing the battery pack, check the volume, squelch, and channel selector switches for smooth, positive rotation. If any damage is present, document the problem completely, and notify the shipping company immediately. Save the foam packing material for possible use at a later date.



ANTENNA INSTALLATION

The rubber flex antenna is easy to install or remove. Just align the BNC connectors correctly at the ANT jack, and twist the BNC plug of the antenna to secure it to the jack on the radio.



A different type of antenna may be used with this transceiver. This antenna must display a feedpoint impedance of 50 ohms for proper operation.

CAUTION

NEVER SQUEEZE THE PUSH TO TALK SWITCH WITHOUT HAVING AN ANTENNA CONNECTED TO THE TOP PANEL ANTENNA JACK.

BATTERY PACK INFORMATION

The NiCd battery pack is a 10.8 volt 450 mAh pack designed expressly for the FTC-2003. We do not recommend the use of other packs. Moreover, the FTC-2003 must never be connected directly to AC power of any kind, nor DC voltages above exactly 12 volts. These abuses will void any and all factory warranties, and these simple precautions should be made clear to the customer. Appropriate warnings are contained in the Operation Manual.

The following procedure will allow quick changing of battery packs:

(1) Use a coin or screwdriver to turn the restraining screw on the rear of the radio counter-clockwise (CCW) by 90° ONLY.

(2) Remove the battery compartment cover.

(3) Install the battery pack in the compartment. Be careful to align the pack with the ⊕ in the top right-hand corner, as shown in the photo.

(4) Replace the battery compartment cover, and make fast the restraining screw with a 90° clockwise (CW) twist.

Note that it is not possible to damage the radio by installing a battery pack incorrectly, as the contacts will not touch any transceiver circuitry.

We recommend that customers carry at least one extra battery pack when operating in a remote area, so as not to be without communications in the event of an emergency.

Use a coin to open battery compartment.

Align ⊕ mark in upper right-hand corner.

BATTERY CHARGER INFORMATION

Several chargers are available for the FTC-2003 battery packs.

The NC-9B is a compact wall charger, similar to the type used with electronic calculators. The miniature phone plug is connected to the EXT jack on the bottom panel of the radio. Charging time is approximately 15 hours to full charge.

The NC-1A is a standard drop-in battery charger. When the FTC-2003 is properly inserted into the charging slot, an LED will become illuminated, indicating proper operation. Charging time is approximately 15 hours for the NC-1A, as well.

The NC-2 is a quick charger and AC adapter. In the quick charge mode, charging time is approximately three hours. A blinking LED on the charger indicates the charge condition; when the blink becomes very short in duration, the charge is full. For base station AC operation, the NC-2 switch may be set accordingly.

Never charge batteries for more than 24 hours.

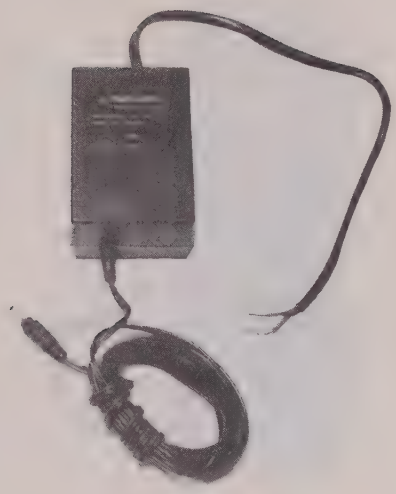
When you want to charge only the battery pack, without tying up the radio in the charger, use the optional FBA-1 Battery Sleeve. This adapter will allow charging of the pack alone.

Most Yaesu Battery Chargers may be used from a variety of supply voltages. The transformer primary wiring diagram for various voltages is shown in Figure 1. The NC-9B cannot be adapted to 220 volts, however. For those voltages, the type NC-9C charger is available from Yaesu agents in those countries using the higher voltages.

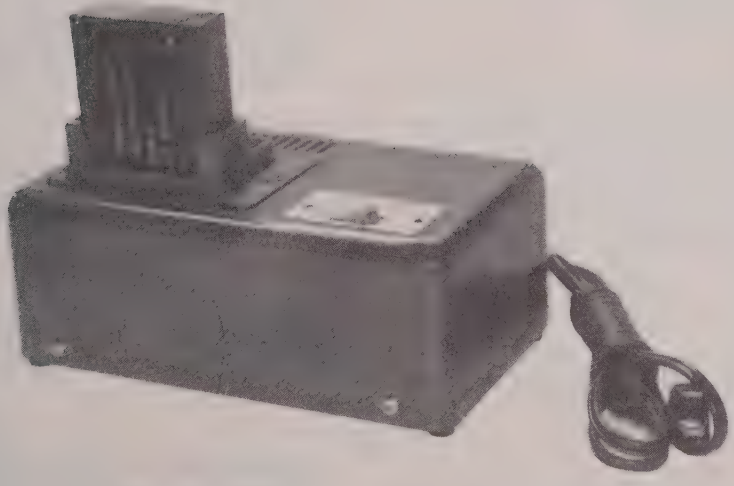
FTC-2003 + NC-2 Quick Charger/AC Adapter

FTC-2003 + NC-1A Battery Charger

NC-9B Compact Charger (117V)

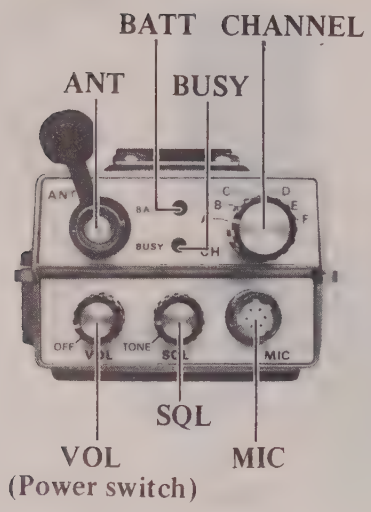


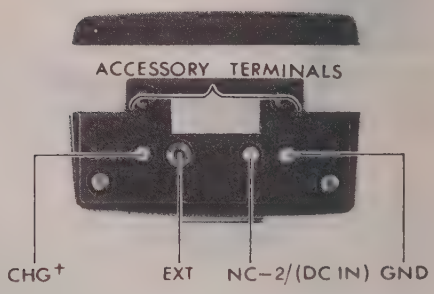
NC-9C Compact Charger (234V)



NC-2 Quick Charger + FNB-1 Battery in FBA-1 Adapter Sleeve

CONTROLS, SWITCHES, AND CONNECTORS





(1) ANT

The antenna connector allows quick connection or removal of the flexible antenna.

(2) BATT

The battery indicator will light up when you transmit, if the battery charge is sufficient. If the indicator does not light up, the battery pack should be recharged as soon as possible.

(3) BUSY

The BUSY lamp lights up when a signal is being received.

(4) CHANNEL

Up to six channels may be selected.

(5) VOL (Power Switch)

This is the main volume and on/off switch for the radio. When operation is completed, or when charging batteries, be certain that the radio is turned OFF, to avoid battery depletion.

(6) SQL

The receiver squelch control will silence the receiver when no signal is being received. This prolongs battery life between charges. For correct adjustment, see the "Operation" section.

(7) MIC

The optional Yaesu YM-24 Speaker/Microphone accessory may be connected here.

(8) PTT switch

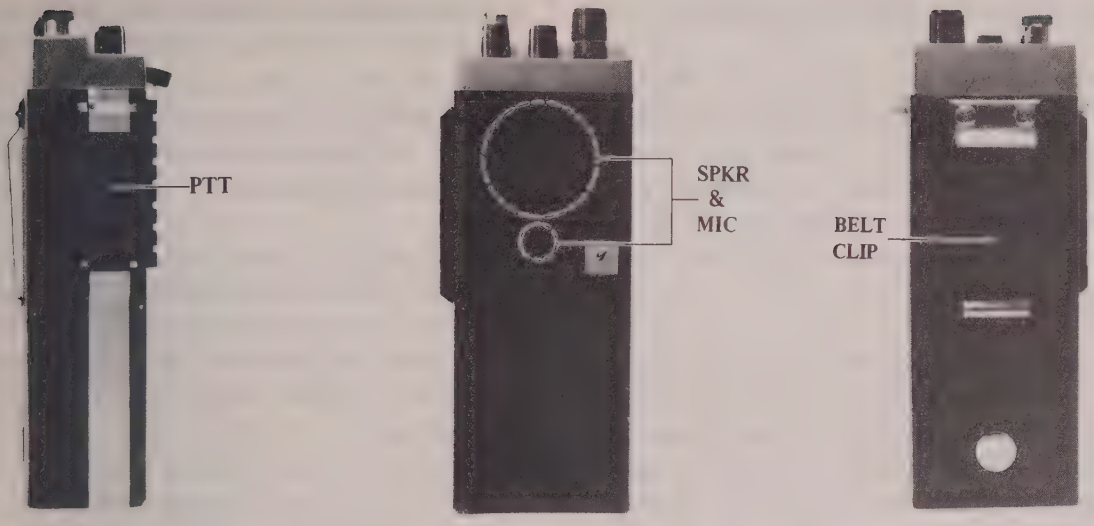
The Push To Talk (PTT) switch will activate the transmitter when you squeeze it. Release the switch to listen.

(9) SPEAKER & MICROPHONE

Behind the slits in the front panel are the built-in speaker and condenser microphone.

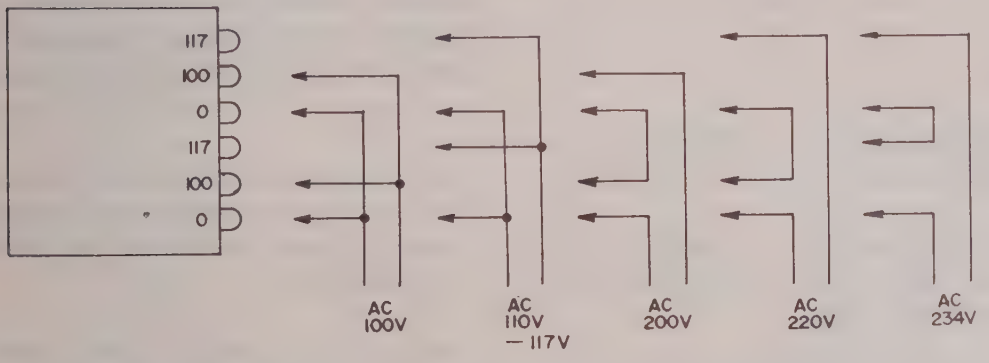
(10) ACCESSORY TERMINALS

These terminals are for connection to the NC-1A NiCd Charger and the NC-2 Quick Charger/AC Adapter. The EXT terminal is for connection to an external charger unit (10.8 VDC @ 45 mA max.).

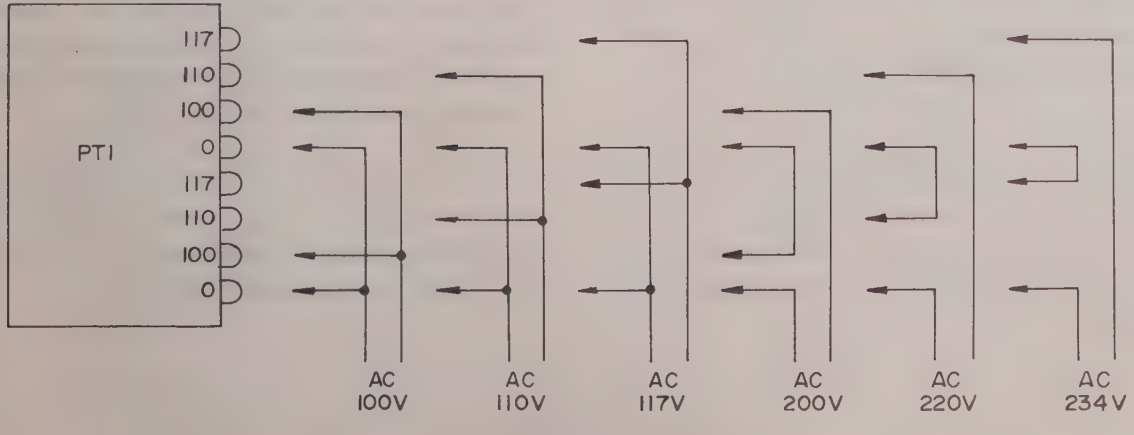


CAUTION

WHEN OPERATING THE FTC-2003 FROM OTHER THAN THE NiCd BATTERY PACK, DO NOT EXCEED THE 10.8 VOLT DC LIMITATION. OPERATION OF THIS UNIT DIRECTLY FROM 13.8 VOLT POWER WILL CAUSE PERMANENT DAMAGE TO THE TRANSCEIVER.



NC-1A



NC-2

Fig. 1 Power Transformer Primary Connections

OPERATION

INSTALLATION AND OWNER TRAINING

The installation procedure for the FTC-2003 is limited to the checking of all switches for proper action, installation of the antenna and battery pack, and confirmation that the transceiver is performing properly. If new channels are to be installed, this manual contains full installation information.

Included with each transceiver is an "Operation Manual" which presents basic operating instructions in an easy-to-understand format. Included are such items as tone squelch operation, speaker-microphone instructions, installation of the battery pack and antenna, and standard operating procedure. Rudimentary information on wave propagation is included, as well, enabling the owner to understand the effects of surrounding buildings and other obstacles. The service technician should become familiar with the operating manual, in order to be able to answer questions that may arise.

The sections to follow are exact reproductions of the corresponding sections of the Owner's Manual. They are presented in this format so as to acquaint you with the terminology familiar to the owner.

OPERATION

Your FTC-2003 transceiver is extremely easy to use. The operation procedure is summarized below.

1. Install the battery pack and the antenna, as described previously. Make certain that your battery pack is fully charged.

2. Turn the VOL switch ON, and rotate the SQL (squelch) control until receiver noise or voices can be heard. Set the VOL control for a comfortable listening level.

3. Rotate the CHANNEL selector to an UNUSED channel, one which has only noise on it. Now rotate the SQL control until the noise just disappears. Do not go past this threshold point; if you do, you will not be able to hear weak signals.

4. Now rotate the CHANNEL selector to the channel you want to use. To call another station, squeeze the PTT switch on the side of the radio, and speak into the grill on the front panel of the radio. A firm, but normal, voice will provide the best quality transmission.

5. When you have finished calling, release the PTT switch. The FTC-2003 will now be in the "receive" mode, and the other station, if returning your call, will be heard in the speaker. Adjust the volume control as necessary for good reception.

6. When all operation is completed, be certain to turn the VOL switch OFF, to avoid battery depletion.

TONE SQUELCH OPERATION

When the optional Tone Squelch unit is installed, rotation of the SQL control to the TONE position will activate the tone squelch circuit.

In this mode, when you transmit, a very low frequency tone (too low for the human ear to perceive) will be sent along with your voice signal. This will activate a similar tone squelch unit at the other station, and he or she will hear you calling normally.

On receive, your radio's receiver will remain silent until a similar subaudible tone is detected on an incoming signal. The receiver will then respond in the normal manner.

When a signal is present on your channel, but that station is not using tone squelch, the BUSY lamp will light up, to tell you that the channel is occupied. Your receiver will stay silent, though. If the BUSY lamp lights up, you should wait until the channel is clear before calling.

The net result is that an otherwise busy channel can be turned into a quiet one, with only desired calls coming through. See your dealer for installation of the optional tone squelch unit.

HOW TO USE THE TWO-TONE ALERTING SYSTEM (OPTION)

If your FTC-2003 is equipped with the optional Two-Tone Sequential alerting unit, the following section will explain how to use it for maximum effectiveness.

In your communications network, each transceiver will have a code number assigned to it. When the dispatcher puts out a special coded call for your unit, an alert tone will be heard in your radio's speaker. You then return the call in the usual fashion. Calls not intended for your unit will not activate your radio at all.

To set up your radio in the paging mode, rotate the SQL control fully clockwise into the click-stop. This is the TONE position, the same one used for Tone Squelch operation. Now, when your code is sent by the dispatcher, an alert tone of about three seconds duration will be heard emanating from your speaker. When the alert tone is finished, you should immediately return the call to the dispatcher.

When your communication is finished, reset the Two-Tone system by rotating the SQL knob out of the click-stop, then rotating it back into the click-stop. You will then be ready for the next time the dispatcher calls you.

USING THE OPTIONAL YM-24 SPEAKER/ MICROPHONE

The basic rules for effective communications presented earlier can be enhanced by use of the YM-24 Speaker/Microphone option, available from your Yaesu dealer.

The YM-24 is a remote hand-held microphone that also contains a speaker. The YM-24 plugs into the MIC jack on the top of your FTC-2003, and no further adjustment is required.

By holding the microphone close to your mouth, and speaking in a firm, normal voice, considerable noise reduction will occur on your transmitted signal. On receive, hold the YM-24 close to your ear, in order to shield your ear from background noise.

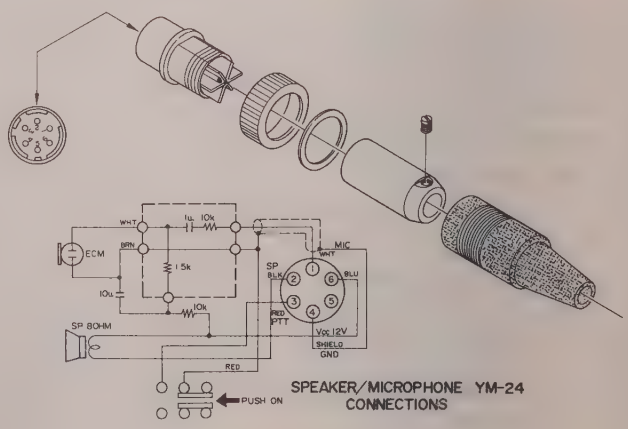
If you are in a difficult communications area, use of the YM-24 will allow you to hold the FTC-2003 high in the air, and to move it around for best reception. The radio may also be mounted on the frame of your backpack, if you are in a remote area, and the YM-24 will then permit sending/ receiving control.

The YM-24 Speaker/Microphone option adds versatility to your Yaesu transceiver.

Squeeze the switch on the YM-24 to talk, and release the switch to listen.

Don't forget to turn the FTC-2003 OFF when not using it. It's easy to forget this important step when using the remote speaker/microphone.

When using the YM-24 Speaker/Microphone, you can raise your FTC-2003 above obstacles that might ruin reception.



YM-24 Speaker/Microphone Connections

THEORY OF OPERATION

Reference to the block diagram will be of considerable help in understanding the operation of the transceiver circuitry. Please refer to the schematic diagram for specific component details.

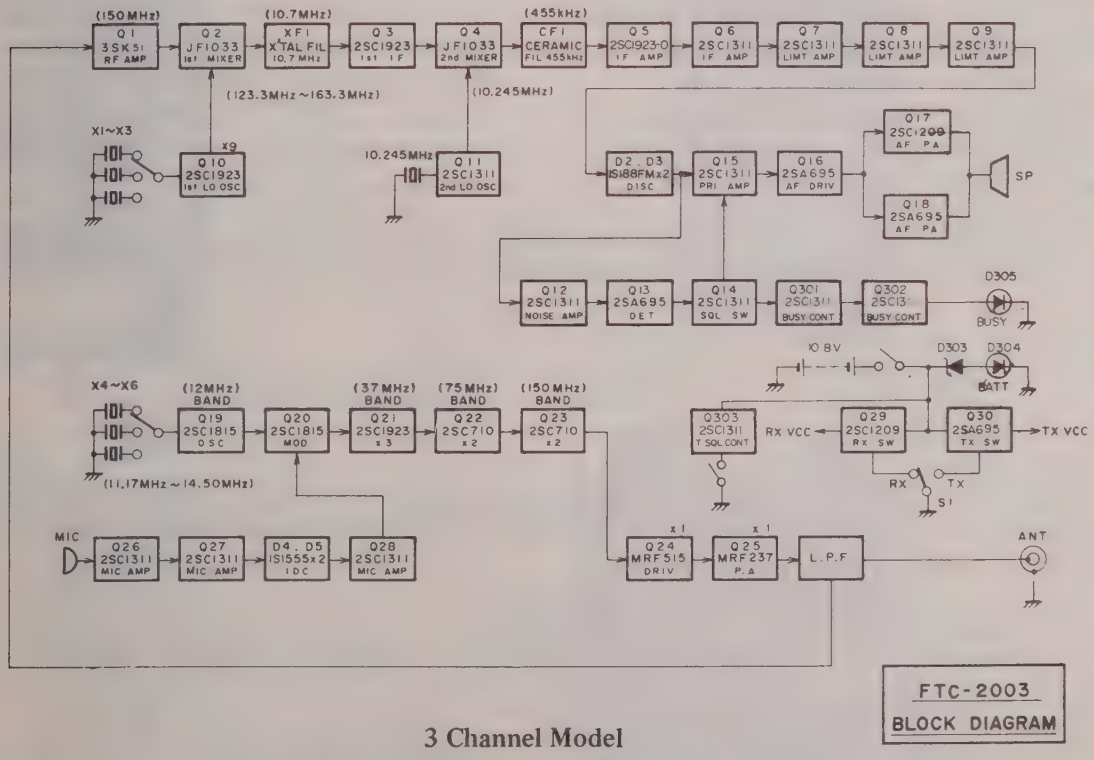
The FTC-2003 utilizes a transmitter strip, as well as a double conversion receiver strip. The FTC-2003 is designed for operation from an internal NiCd battery pack.

RECEIVER

The signal from the antenna is fed through a low-pass filter consisting of C_{401}, C_{402}, L_{401}, C_{110}, and L_{11}, as well as diode switch D_1, to the MOS FET RF amplifier, Q_1 (3SK51). The amplified VHF signal is then heterodyned with the local oscillator signal supplied from Q_{10} (2SC1923) in first mixer Q_2 (JF1033), producing a 10.7 MHz first IF. The IF signal is then passed through crystal filter XF_1, which has a 6 dB bandwidth of ±7.5 kHz, and fed to IF amplifier Q_3 (2SC1923).

The filtered IF signal appears at the gate of second mixer Q_4 (JF1033), where the 10.7 MHz signal is heterodyned with a 10.245 MHz local signal delivered from Q_{11} (2SC1311), producing a 455 kHz second IF. The 455 kHz signal is passed through ceramic filter CF_1, which has a 6 dB bandwidth of ±5.5 kHz, and fed to second IF amplifiers Q_5 and Q_6 (2SC1311). The ceramic filter minimizes degradation of receiver performance caused by spurious responses, and it sets the working bandwidth for following stages. The amplified IF signal is delivered to the three-stage limiter amplifier, Q_7–Q_9 (2SC1311), in which any traces of amplitude modulation are removed. The IF signal is then delivered to the discriminator.

The discriminator, D_2/D_3 (1S188FM), produces an audio output in response to a corresponding change in the frequency of the 455 kHz IF signal. The audio signal is then amplified by Q_{15} (2SC1311), Q_{16} (2SA695), Q_{17} (2SC1209), and Q_{18} (2SA695), providing 500 mW of audio to the speaker.



3 Channel Model

When no carrier is present in the 455 kHz IF, the high frequency noise at the discriminator output is amplified by noise amplifier Q_{12} (2SC1311) and detected by Q_{13} (2SA695), producing a DC voltage. This voltage activates a switch, Q_{14} (2SC1311), which grounds the base of Q_{15}, silencing the receiver. When a carrier is present in the 455 kHz IF, the noise is removed from the discriminator, and the audio amplifier stages return to normal operation.

TRANSMITTER

The transmitter section produces a frequency modulated signal. The audio signal from the microphone is amplified by Q_{26} and Q_{27} (2SC1311), then passed to the instantaneous deviation control (IDC), where both positive and negative peaks are clipped by D_4 and D_5 (1S1555). The output from the IDC is fed to VR_1, which sets the input level for microphone amplifier Q_{28} (2SC1311). The amplified signal is then passed to the modulator.

A 12 MHz fundamental signal is generated by Q_{19} (2SC1815). The fundamental signal is fed to the base of Q_{20} (2SC1815); the signal appearing at the emitter of Q_{20} is a vector phase modulated signal, because of the reactance variation produced in accordance with the speech input from Q_{28}.

The low-level signal is then multiplied by a total factor of 12 in the frequency multiplier stages: Q_{21} (2SC1923), Q_{22} (2SC710), and Q_{23} (2SC710). The VHF signal is then delivered to driver transistor Q_{24} (MRF515), and amplified by power amplifier Q_{25} (MRF237), the output of which is fed through a low-pass filter to the antenna. Power output is approximately three watts.

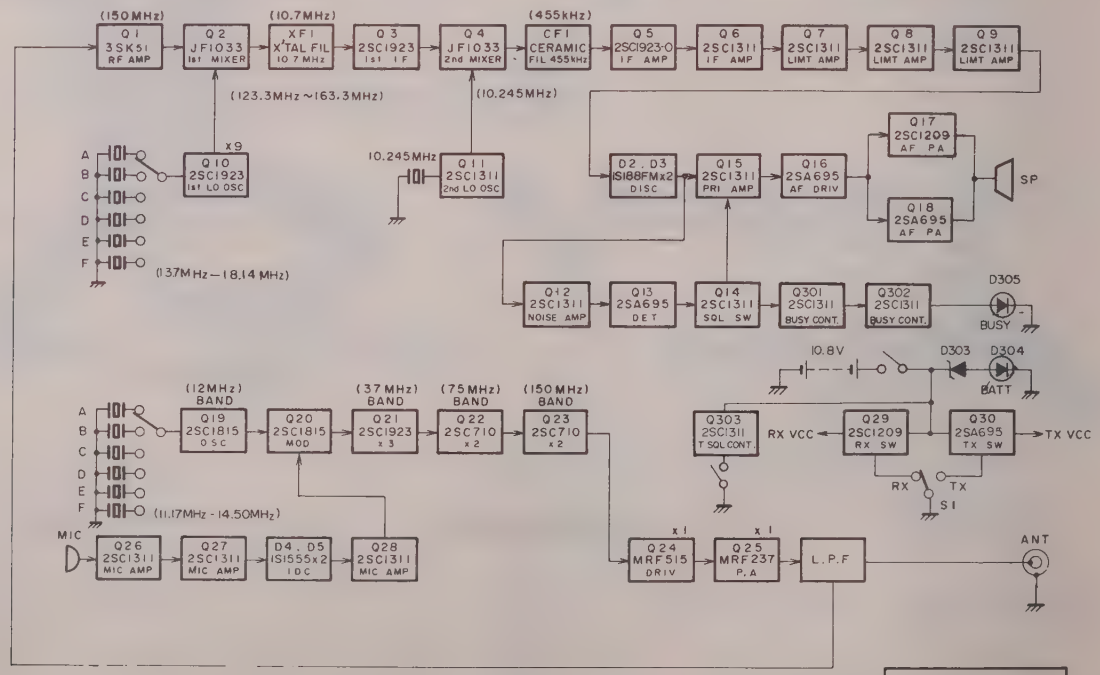
CONTROL CIRCUITRY

In the receive mode, the PTT switch connection causes Q_{29} (2SC1209) to conduct, providing Vcc to be applied to the receiver section. In the transmit mode, the conduction of Q_{30} (2SA695) causes Vcc to be applied to the transmitter circuit, while D_7 causes the base of Q_{29} to be grounded, thus disabling the receiver.

The microphone is grounded when the PTT switch is released. When the optional external speaker/microphone is used, the internal microphone is disabled.

When a signal is received by the main squelch system, a portion of the DC voltage appearing at Q_{14} is used to switch Q_{301} and Q_{302} (2SC1311) on, causing the BUSY LED to become illuminated.

In the transmit mode, the DC voltage from the battery is sampled by zener diode D_{303} (WZ061). When the battery level is above 8 volts, D_{303} will conduct, causing the BATT indicator LED to become illuminated, providing an indication of satisfactory battery charge.



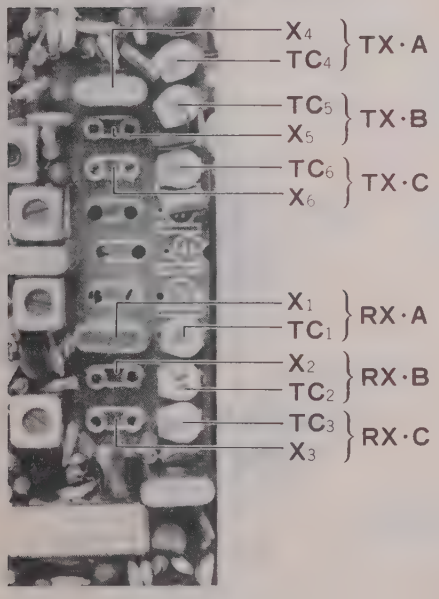
6 Channel Model

FTC-2003
BLOCK DIAGRAM

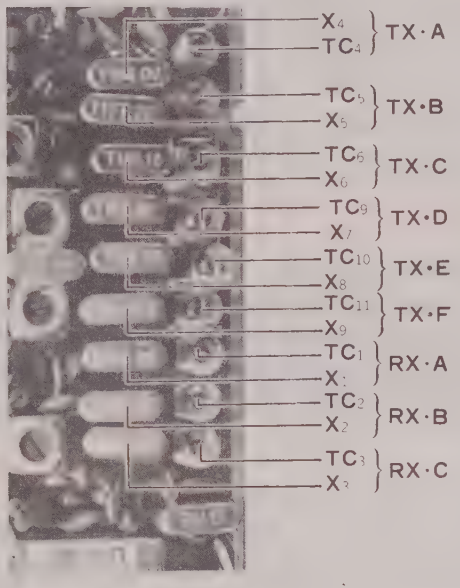
CRYSTAL DATA

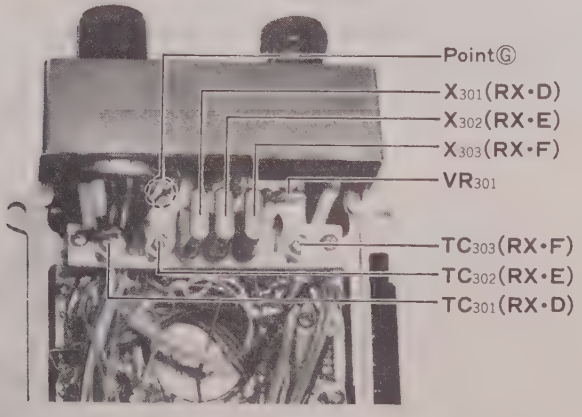
1. Type of holder	HC-25/U
2. Channel Frequency:	134 MHz – 174 MHz
3. Oscillation frequency:	TX: CH/12 RX: (CH-10.7)/9
4. Load Capacity:	TX: 50pF + 60Hz = 0 RX: 34.3pF – 90Hz = 0
5. Drive Level:	TS-683/TSM 2mW
6. Shunt Capacity:	TX: 12MHz – 4.3pF±0.5 13MHz – 4.5pF±0.5 14MHz – 4.8pF±0.5 RX: 15MHz – 4.5pF±0.5 16MHz – 5.0pF±0.5
7. Frequency Tolerance:	±10 ppm at 25°C
8. Frequency Stability:	±10 ppm –10°C to +50°C
9. Equivalent Resistance:	13 ohms max (series)
10. Operation mode:	Fundamental

3 Channel Model



6 Channel Model





CRYSTAL LOCATION DATA

OPTIONAL TONE SQUELCH (CTCSS) INSTALLATION

The optional FTS-1 Tone Squelch board can be supplied complete with the IC and all components, or minus the IC and frequency determining parts.

To install the Tone Squelch board, first remove the rear panel of the transceiver, as shown in Figure 12, page 3-6. Now remove the bottom panel of the transceiver, as shown in Figure 4.

Ascertain the customer's required tone frequency, and select the proper value for R_{502}, as determined from inspection of Table 2. In countries outside the United States, trimpot VR_{502} is in series with R_{502}; the proper values for the combination of these two components can also be found in Table 2.

Once the proper resistor is installed, mount the circuit board on the bottom side of the transceiver, as shown in Figure 4. Secure the board using the mounting hardware supplied. Now connect the wires extending from the circuit board to points (a), (b), (c), (d), (e), (f), and GND, as shown in Figure 3.

For alignment,purposes, VR_{501} sets the input audio level to the CTCSS decoder. It should be set to the 12 o'clock position (minimum) for normal use. VR_{503} sets the subaudible output level, and this should be set for ±0.5 kHz deviation on transmit.

Close up the transceiver. Installation is now complete. When the SQL control is set to TONE, a subaudible tone will be transmitted along with the speech signal. On receive, an identical sub-audible tone will be required to open up the transceiver squelch. Rotate the SQL control out of the TONE position for normal squelch operation.

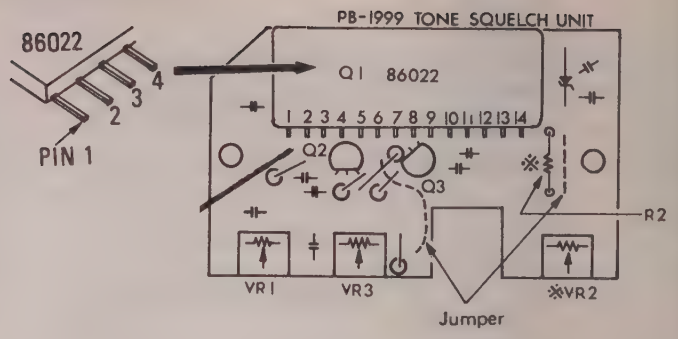


Fig. 2

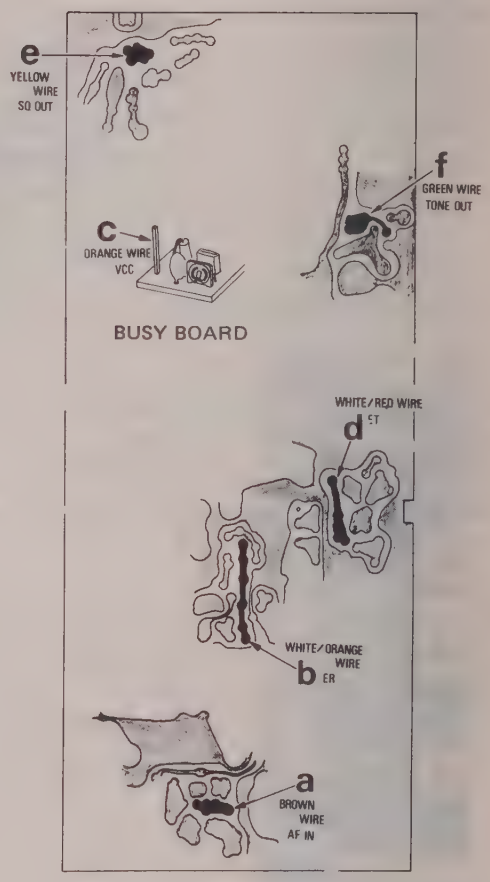


Fig. 3

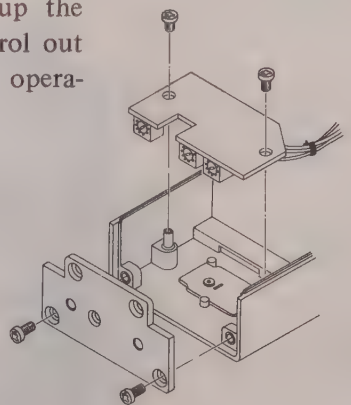


Fig. 4

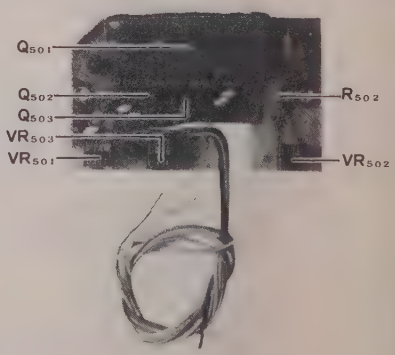


Fig. 5

TONE SQUELCH TUNING RESISTOR CHART

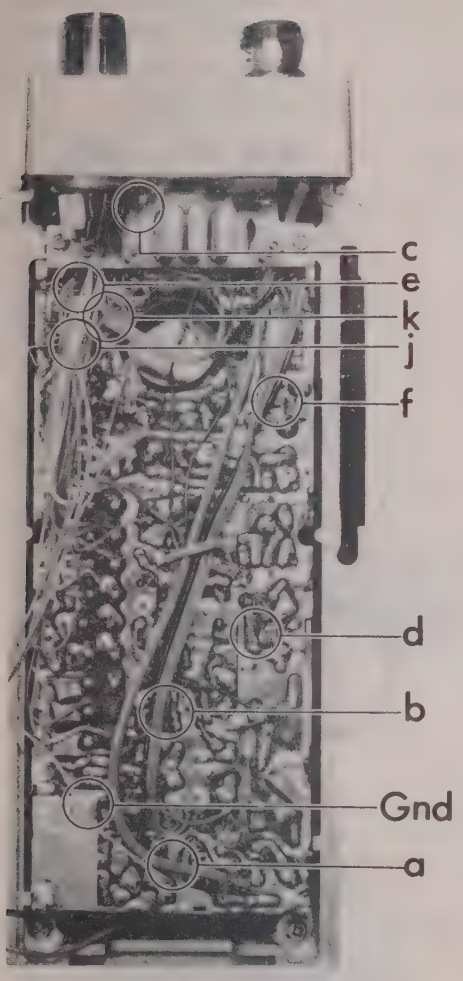


Fig. 6

TUNING RESISTORS

CTCSS Frequency (Hz)	R_{502} (kOhms)
67.0	180.441
71.9	156.684
74.4	146.331
77.0	136.616
79.7	127.517
81.0	123.456
82.5	119.008
85.4	111.062
88.5	103.418
90.0	100.000
91.5	96.748
94.8	90.129
100.0	81.000
103.5	75.614
107.2	70.484
110.9	65.860
114.8	61.461
118.8	57.392
123.0	53.539
127.3	199.934
131.8	186.515
136.5	173.892
141.3	162.278
146.2	151.582
151.4	141.349
156.7	131.949
162.2	123.152
167.9	114.932
169.0	113.441
173.8	107.261
179.9	100.111
186.2	93.451
188.0	91.670
192.8	87.162
203.5	78.237
209.0	74.174
210.7	72.982
218.1	68.113
225.7	63.603
233.6	59.374
241.8	55.415
250.3	51.715

Table 2

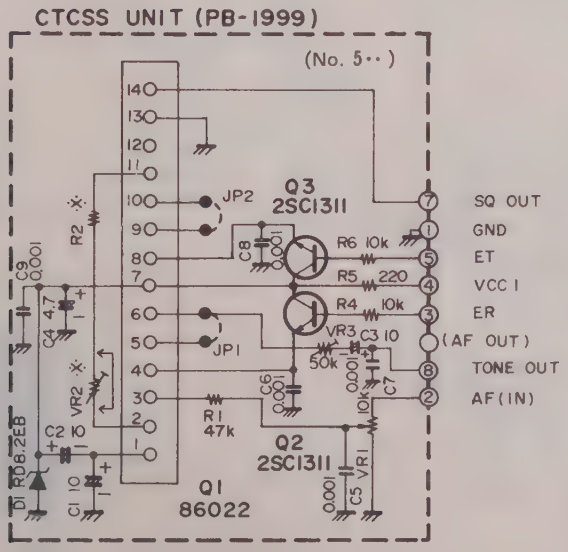
R_{502} VALUE (WHEN USING TRIMPOT)

Table A		Table B	
Tone frequency	R_{502}	Tone frequency	R_{502}
(Hz)	(kΩ)	(Hz)	(kΩ)
67.0	165	91.5	88.7
71.9	143	94.8	84.5
74.4	133	100	75.0
77.0	124	103.5	71.5
79.7	118	107.2	64.9
81.0	113	110.9	60.4
82.5	110	114.8	56.2
85.4	102	118.8	52.3
88.5	95.3	123.0	49.9
90.0	93.1	186.2	86.6
127.3	182	188.0	84.5
131.8	169	192.8	80.6
136.5	158	203.5	71.5
141.3	150	209.0	68.1
146.2	137	210.7	66.5
151.4	130	218.1	63.4
156.7	121	225.7	59.0
162.2	113	233.6	54.6
167.9	105	241.8	51.1
169.0	105	250.3	47.5
173.8	97.6		
179.9	93.1		

Note: 1. Please use 1% tolerance metallic film resistors.
2. VR_{502} value: when using table A, 20 kΩ; table B, 10 kΩ

Table 3

NOTE:
Tuning resistors are metal film, 50 ppm/°C and ±0.1% tolerance. Stable trim pots of comparable quality may also be used in series with ±1.0% tolerance resistors.



OPTIONAL TWO-TONE SEQUENTIAL DECODER INSTALLATION

The optional F2D-1 Two-Tone Sequential Decoder board can be supplied complete with the IC and all components, or minus the IC and frequency determining parts. The board is installed in the same position as the Tone Squelch board, but the mounting procedure and interconnections to the transceiver are slightly different.

First, select the two tones for the set as determined by the requirements of the customer's system. Refer to Table 4, and select the values of R_{601} – R_{604} required to provide the proper programming of the tone board.

Mount the circuit board on the bottom side of the transceiver, as shown in Figure 9. Use the spacers provided, and note that the mounting procedure is slightly different from that of the tone squelch board. Secure the board to the mounting posts using the nuts and bolts supplied.

Connect the six wires extending from the circuit board to points (a), (c), (e), (j), (k), and GND, as shown in Figure 8. The above letters are also shown on the schematic diagram for the transceiver.

For alignment purposes, VR_{601} sets the input audio level to the decoder. It should be set to the 12 o'clock position or more for normal operation. VR_{602} sets the alert tone output level, and this control should be set to the level desired by the customer.

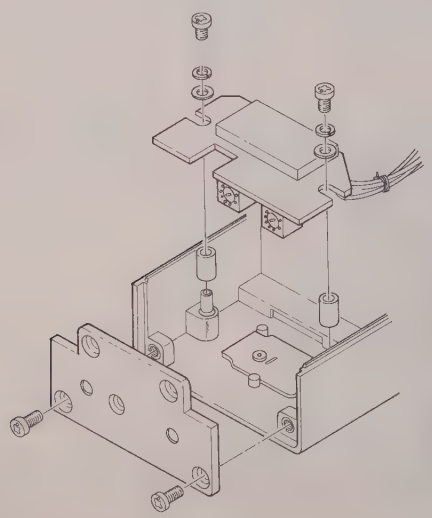


Fig. 9

Close up the transceiver. Installation is now complete. In service, the SQL control is set to TONE, and an alert tone is sent when the proper sequential code for the transceiver is received. Rotate the SQL control out of the TONE position click-stop to stop the tone. Reset the decoder by setting the SQL control again to TONE.

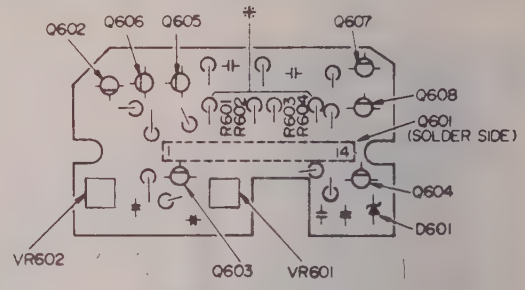


Fig. 7

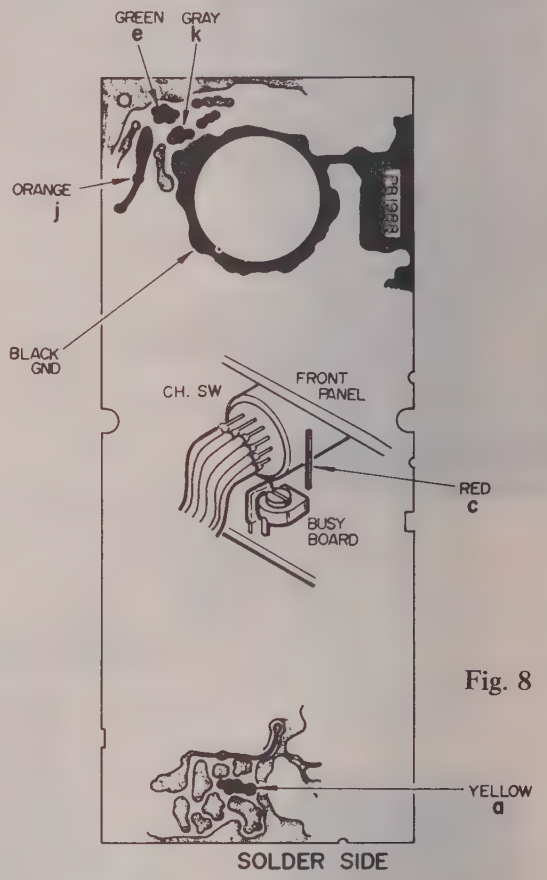


Fig. 8

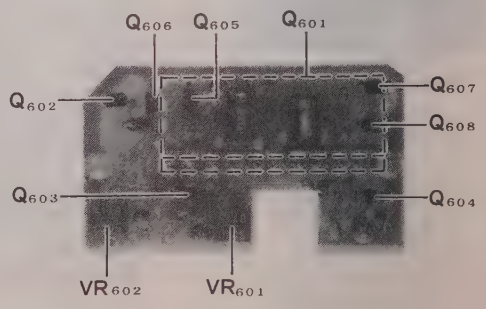


Fig. 10

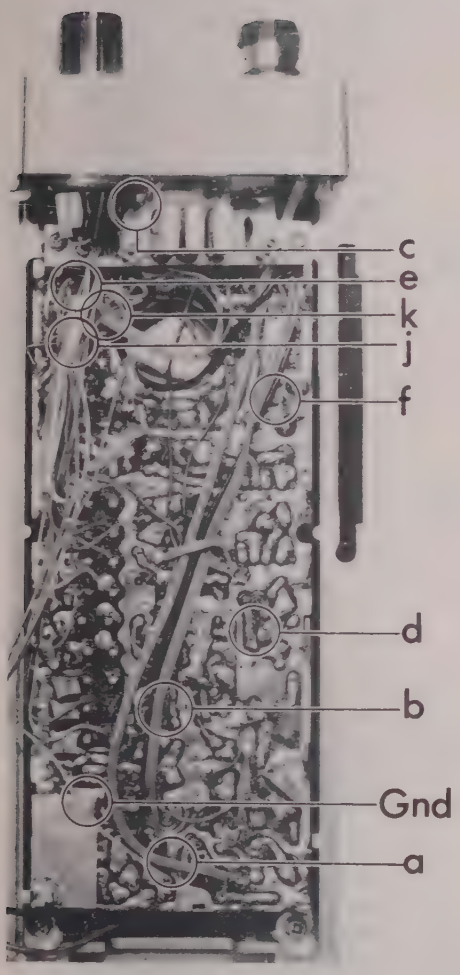
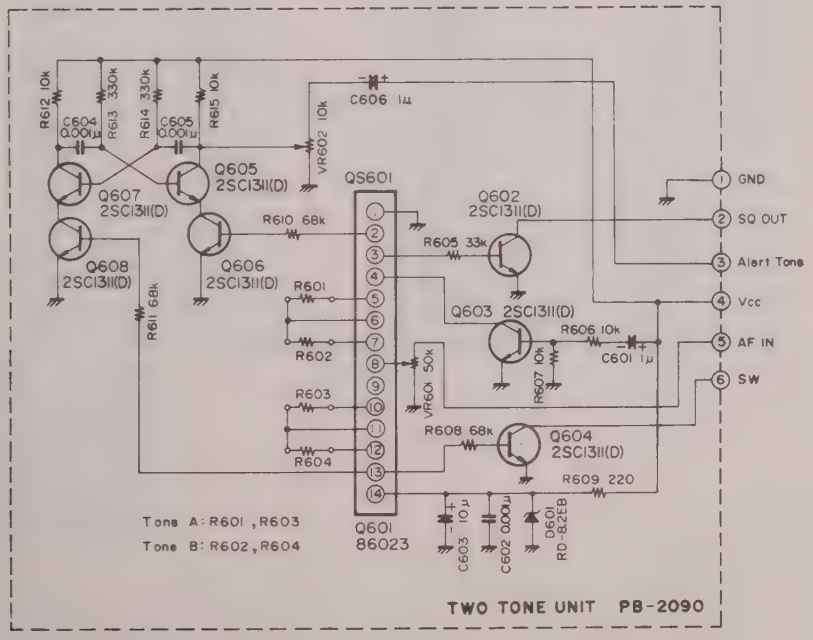


Fig. 11

TWO TONE DECODER TUNING RESISTORS

TONE FRE-QUENCY (Hz)	TUNING R $R_{601} = R_{603}$ $R_{602} = R_{604}$ (K ohms)	TONE FRE-QUENCY (Hz)	TUNING R $R_{601} = R_{603}$ $R_{602} = R_{604}$ (K ohms)	TONE FRE-QUENCY (Hz)	TUNING R $R_{601} = R_{603}$ $R_{602} = R_{604}$ (K ohms)
238.6Hz	300.60kΩ	524.8Hz	135.58kΩ	1153.4Hz	60.598kΩ
241.8	296.59	539.0	131.95	1185.2	58.918
245.1	292.57	553.9	128.35	1190.0	58.672
250.3	286.45	569.1	124.87	1217.8	57.287
251.9	284.62	582.1	122.03	1220.0	57.180
254.1	282.14	584.8	121.46	1240.0	56.226
258.8	276.98	600.9	118.15	1251.4	55.695
266.0	269.43	617.4	114.94	1265.0	55.075
273.3	262.18	634.5	111.79	1281.0	54.362
280.8	255.12	645.7	109.82	1285.8	54.152
281.1	254.85	651.9	108.75	1291.4	53.908
288.5	248.26	669.9	105.78	1320.0	52.697
296.5	241.51	688.3	102.90	1321.2	52.647
304.7	234.95	707.3	100.08	1330.0	52.286
312.6	228.97	716.1	98.824	1341.2	51.832
313.0	228.67	726.8	97.340	1355.0	51.284
321.7	222.43	746.8	94.679	1357.6	51.182
330.5	216.46	767.4	92.084	1395.0	49.756
339.6	210.60	788.5	89.566	1397.4	49.667
346.7	206.25	794.3	88.898	1400.0	49.571
349.0	204.88	810.2	87.114	1430.5	48.472
358.6	199.34	832.5	84.727	1433.4	48.370
368.5	193.93	855.5	82.395		
378.6	188.70	879.0	80.139		
384.6	185.73	881.0	79.952		
389.0	183.60	903.2	77.938		
399.8	178.59	928.1	75.793		
410.8	173.75	953.7	73.705		
422.1	169.05	977.2	71.885		
426.6	167.25	979.9	71.681		
433.7	164.47	1000.0	70.200		
445.7	159.99	1006.9	69.705		
457.9	155.68	1034.0	67.826		
470.5	151.45	1049.6	66.788		
473.2	150.58	1063.2	65.908		
483.5	147.33	1084.0	64.605		
484.4	146.93	1092.4	64.093		
496.8	143.33	1120.0	62.464		
510.5	139.43	1122.5	62.321		
524.6	135.63	1151.0	60.728		

Table 4



Y2T TWO-TONE PROGRAMMING KITS
TWO-TONE CODE TABLE

Y2T Kit Number:	Tone Pair:		Resistor Values (Note 1):		Y2T Kit Number:	Tone Pair:		Resistor Values (Note 1):	
	Tone A(Hz)	Tone B(Hz)	R601 R603 (KΩ)	R602 R604 (KΩ)		Tone A(Hz)	Tone B(Hz)	R601 R603 (KΩ)	R602 R604 (KΩ)
Y2T-101	330.5	349.0	216.46	204.88	Y2T-150	433.7	330.5	164.47	216.46
-102	〃	368.5	〃	193.93	-151	〃	349.0	〃	204.88
-103	〃	389.0	〃	183.60	-152	〃	368.5	〃	193.93
-104	〃	410.8	〃	173.75	-153	〃	389.0	〃	183.60
-105	〃	433.7	〃	164.47	-154	〃	410.8	〃	173.75
-106	〃	457.9	〃	155.68	-156	〃	457.9	〃	155.68
-107	〃	483.5	〃	147.33	-157	〃	483.5	〃	147.33
-108	〃	510.5	〃	139.43	-158	〃	510.5	〃	139.43
-109	〃	539.0	〃	131.95	-159	〃	539.0	〃	131.95
Y2T-110	349.0	330.5	204.88	216.46	Y2T-160	457.9	330.5	155.68	216.46
-112	〃	368.5	〃	193.93	-161	〃	349.0	〃	204.88
-113	〃	389.0	〃	183.60	-162	〃	368.5	〃	193.93
-114	〃	410.8	〃	173.75	-163	〃	389.0	〃	183.60
-115	〃	433.7	〃	164.47	-164	〃	410.8	〃	173.75
-116	〃	457.9	〃	155.68	-165	〃	433.7	〃	164.47
-117	〃	483.5	〃	147.33	-167	〃	483.5	〃	147.33
-118	〃	510.5	〃	139.43	-168	〃	510.5	〃	139.43
-119	〃	539.0	〃	131.95	-169	〃	539.0	〃	131.95
Y2T-120	368.5	330.5	193.93	216.46	Y2T-170	483.5	330.5	147.33	216.46
-121	〃	349.0	〃	204.88	-171	〃	349.0	〃	204.88
-123	〃	389.0	〃	183.60	-172	〃	368.5	〃	193.93
-124	〃	410.8	〃	173.75	-173	〃	389.0	〃	183.60
-125	〃	433.7	〃	164.47	-174	〃	410.8	〃	173.75
-126	〃	457.9	〃	155.68	-175	〃	433.7	〃	164.47
-127	〃	483.5	〃	147.33	-176	〃	457.9	〃	155.68
-128	〃	510.5	〃	139.43	-178	〃	510.5	〃	139.43
-129	〃	539.0	〃	131.95	-179	〃	539.0	〃	131.95
Y2T-130	389.0	330.5	183.60	216.46	Y2T-180	510.5	330.5	139.43	216.46
-131	〃	349.0	〃	204.88	-181	〃	349.0	〃	204.88
-132	〃	368.5	〃	193.93	-182	〃	368.5	〃	193.93
-134	〃	410.8	〃	173.75	-183	〃	389.0	〃	183.60
-135	〃	433.7	〃	164.47	-184	〃	410.8	〃	173.75
-136	〃	457.9	〃	155.68	-185	〃	433.7	〃	164.47
-137	〃	483.5	〃	147.33	-186	〃	457.9	〃	155.68
-138	〃	510.5	〃	139.43	-187	〃	483.5	〃	147.33
-139	〃	539.0	〃	131.95	-189	〃	539.0	〃	131.95
Y2T-140	410.8	330.5	173.75	216.46	Y2T-190	539.0	330.5	131.95	216.46
-141	〃	349.0	〃	204.88	-191	〃	349.0	〃	204.88
-142	〃	368.5	〃	193.93	-192	〃	368.5	〃	193.93
-143	〃	389.0	〃	183.60	-193	〃	389.0	〃	183.60
-145	〃	433.7	〃	164.47	-184	〃	410.8	〃	173.75
-146	〃	457.9	〃	155.68	-195	〃	433.7	〃	164.47
-147	〃	483.5	〃	147.33	-196	〃	457.9	〃	155.68
-148	〃	510.5	〃	139.43	-197	〃	483.5	〃	147.33
-149	〃	539.0	〃	131.95	-198	〃	510.5	〃	139.43

NOTE 1: This chart applies to the Two-Tone Sequential Decoder modules for the FTC-2003 as well as the FTC-2025/2040. For the FTC-2003, the Tone A resistors of interest are R601 and R603, and the Tone B resistors are R602 and R604. For the FTC-2025/2040 the Tone A resistors are R1101 and R1103, while the Tone B resistors are R1102 and R1104.

Y2T TWO-TONE PROGRAMMING KITS

TWO-TONE CODE TABLE

Y2T Kit Number:	Tone Pair:		Resistor Values (Note 1):		Y2T Kit Number	Tone Pair:		Resistor Values (Note 1):	
	Tone A(Hz)	Tone B(Hz)	R601 R603 KΩ	R602 R604 (KΩ)		Tone A (Hz)	Tone B (Hz)	R601 R603 (KΩ)	R602 R604 KΩ
Y2T-201	569.1	600.9	124.87	118.15	Y2T-250	746.8	569.1	94.679	124.87
-202	〃	634.5	〃	111.79	-251	〃	600.9	〃	118.15
-203	〃	669.9	〃	105.78	-252	〃	634.5	〃	111.79
-204	〃	707.3	〃	100.08	-253	〃	669.9	〃	105.78
-205	〃	746.8	〃	94.679	-254	〃	707.3	〃	100.08
-206	〃	788.5	〃	89.566	-256	〃	788.5	〃	89.566
-207	〃	832.5	〃	84.727	-257	〃	832.5	〃	84.727
-208	〃	879.0	〃	80.136	-258	〃	879.0	〃	80.136
-209	〃	928.1	〃	75.793	-259	〃	928.1	〃	75.793
Y2T-210	600.9	569.1	118.15	124.87	Y2T-260	788.5	569.1	89.566	124.87
-212	〃	634.5	〃	111.79	-261	〃	600.9	〃	118.15
-213	〃	669.9	〃	105.78	-262	〃	634.5	〃	111.79
-214	〃	707.3	〃	100.08	-263	〃	669.9	〃	105.78
-215	〃	746.8	〃	94.679	-264	〃	707.3	〃	100.08
-216	〃	788.5	〃	89.566	-265	〃	746.8	〃	94.679
-217	〃	832.5	〃	84.727	-267	〃	832.5	〃	84.727
-218	〃	879.0	〃	80.136	-268	〃	879.0	〃	80.136
-219	〃	928.1	〃	75.793	-269	〃	928.1	〃	75.793
Y2T-220	634.5	569.1	111.79	124.87	Y2T-270	832.5	569.1	84.727	124.87
-221	〃	600.9	〃	118.15	-271	〃	600.9	〃	118.15
-223	〃	669.9	〃	105.78	-272	〃	634.5	〃	111.79
-224	〃	707.3	〃	100.08	-273	〃	669.9	〃	105.78
-225	〃	746.8	〃	94.679	-274	〃	707.3	〃	100.08
-226	〃	788.5	〃	89.566	-275	〃	746.8	〃	94.679
-227	〃	832.5	〃	84.727	-276	〃	788.5	〃	89.566
-228	〃	879.0	〃	80.136	-278	〃	879.0	〃	80.136
-229	〃	928.1	〃	75.793	-279	〃	928.1	〃	75.793
Y2T-230	669.9	569.1	105.78	124.87	Y2T-280	879.0	569.1	80.139	124.87
-231	〃	600.9	〃	118.15	-281	〃	600.9	〃	118.15
-232	〃	634.5	〃	111.79	-282	〃	634.5	〃	111.79
-234	〃	707.3	〃	100.08	-283	〃	669.9	〃	105.78
-235	〃	746.8	〃	94.679	-284	〃	707.3	〃	100.08
-236	〃	788.5	〃	89.566	-285	〃	746.8	〃	94.679
-237	〃	832.5	〃	84.727	-286	〃	788.5	〃	89.566
-238	〃	879.0	〃	80.136	-287	〃	832.5	〃	84.727
-239	〃	928.1	〃	75.793	-289	〃	928.1	〃	75.793
Y2T-240	707.3	569.1	100.08	124.87	Y2T-290	928.1	569.1	75.793	124.87
-241	〃	600.9	〃	118.15	-291	〃	600.9	〃	118.15
-242	〃	634.5	〃	111.79	-292	〃	634.5	〃	111.79
-243	〃	669.9	〃	105.78	-293	〃	669.9	〃	105.78
-245	〃	746.8	〃	94.679	-294	〃	707.3	〃	100.08
-246	〃	788.5	〃	89.566	-295	〃	746.8	〃	94.679
-247	〃	832.5	〃	84.727	-296	〃	788.5	〃	89.566
-248	〃	879.0	〃	80.136	-297	〃	832.5	〃	84.727
-249	〃	928.1	〃	75.793	-298	〃	879.0	〃	80.136

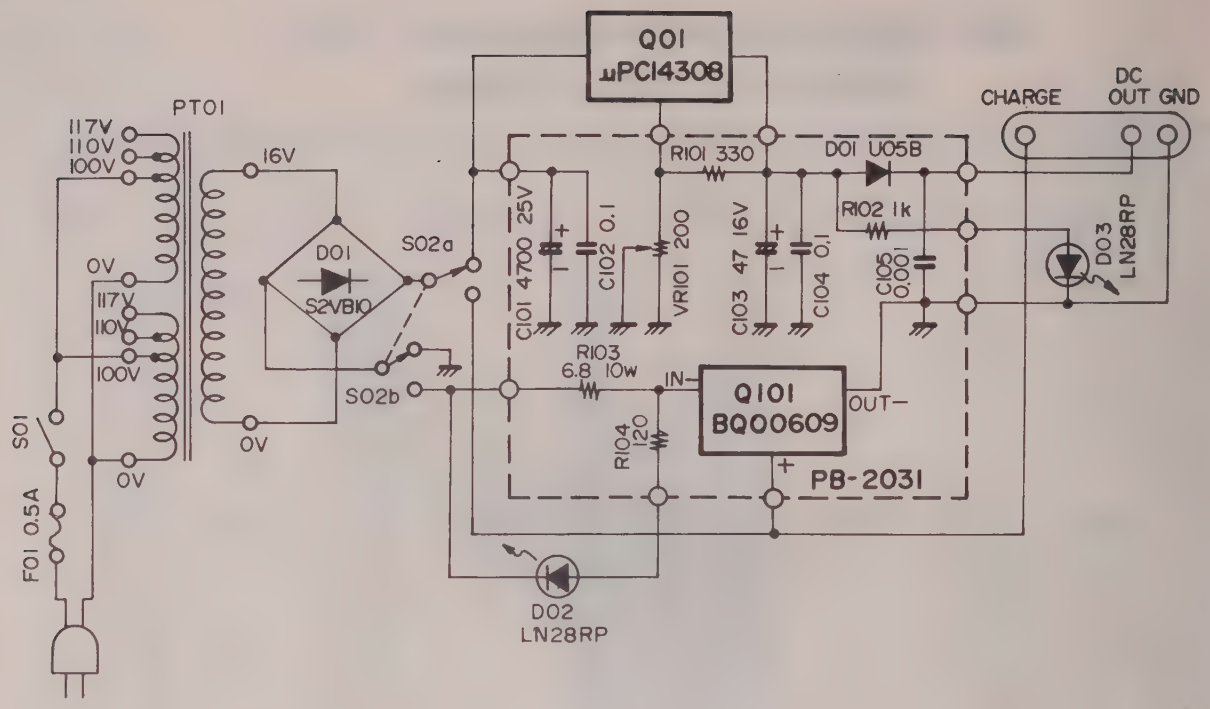
Y2T TWO-TONE PROGRAMMING KITS
TWO-TONE CODE TABLE

Y2T Kit Number:	Tone Pair:		Resistor Values (Note 1):		Y2T Kit Number:	Tone Pair:		Resistor Values (Note 1):	
	Tone A(Hz)	Tone B(Hz)	R601 R603 (KΩ)	R602 R604 (KΩ)		Tone A(Hz)	Tone B(Hz)	R601 R603 (KΩ)	R602 R604 (KΩ)
Y2T-401	321.7	339.6	222.43	210.60	Y2T-450	422.1	321.7	169.05	222.43
-402	〃	358.6	〃	199.34	-451	〃	339.6	〃	210.60
-403	〃	378.6	〃	188.70	-452	〃	358.6	〃	199.34
-404	〃	399.8	〃	178.59	-453	〃	378.6	〃	188.70
-405	〃	422.1	〃	169.05	-454	〃	399.8	〃	178.59
-406	〃	445.7	〃	159.99	-456	〃	445.7	〃	159.99
-407	〃	470.5	〃	151.45	-457	〃	470.5	〃	151.45
-408	〃	496.8	〃	143.33	-458	〃	496.8	〃	143.33
-409	〃	524.6	〃	135.63	-459	〃	524.6	〃	135.63
Y2T-410	339.6	321.7	210.60	222.43	Y2T-460	445.7	321.7	159.99	222.43
-412	〃	358.6	〃	199.34	-461	〃	339.6	〃	210.60
-413	〃	378.6	〃	188.70	-462	〃	358.6	〃	199.34
-414	〃	399.8	〃	178.59	-463	〃	378.6	〃	188.70
-415	〃	422.1	〃	169.05	-464	〃	399.8	〃	178.59
-416	〃	445.7	〃	159.99	-465	〃	422.1	〃	169.05
-417	〃	470.5	〃	151.45	-467	〃	470.5	〃	151.45
-418	〃	496.8	〃	143.33	-468	〃	496.8	〃	143.33
-419	〃	524.6	〃	135.63	-469	〃	524.6	〃	135.63
Y2T-420	358.6	321.7	199.34	222.43	Y2T-470	470.5	321.7	151.45	222.43
-421	〃	339.6	〃	210.60	-471	〃	339.6	〃	210.60
-423	〃	378.6	〃	188.70	-472	〃	358.6	〃	199.34
-424	〃	399.8	〃	178.59	-473	〃	378.6	〃	188.70
-425	〃	422.1	〃	169.05	-474	〃	399.8	〃	178.59
-426	〃	445.7	〃	159.99	-475	〃	422.1	〃	169.05
-427	〃	470.5	〃	151.45	-476	〃	445.7	〃	159.99
-428	〃	496.8	〃	144.33	-478	〃	496.8	〃	143.33
-429	〃	524.6	〃	135.63	-479	〃	524.6	〃	135.63
Y2T-430	378.6	321.7	188.70	222.43	Y2T-480	496.8	321.7	143.33	222.43
-431	〃	339.6	〃	210.60	-481	〃	339.6	〃	210.60
-432	〃	358.6	〃	199.34	-482	〃	358.6	〃	199.34
-434	〃	399.8	〃	178.59	-483	〃	378.6	〃	188.70
-435	〃	422.1	〃	169.05	-484	〃	399.8	〃	178.59
-436	〃	445.7	〃	159.99	-485	〃	422.1	〃	169.05
-437	〃	470.5	〃	151.45	-486	〃	445.7	〃	159.99
-438	〃	496.8	〃	143.33	-487	〃	470.5	〃	151.45
-439	〃	524.6	〃	135.63	-489	〃	524.6	〃	135.63
Y2T-440	399.8	321.7	178.59	222.43	Y2T-490	524.6	321.7	135.63	222.43
-441	〃	339.6	〃	210.60	-491	〃	339.6	〃	210.60
-442	〃	358.6	〃	199.34	-492	〃	358.6	〃	199.34
-443	〃	378.6	〃	188.70	-493	〃	378.6	〃	188.70
-445	〃	422.1	〃	169.05	-494	〃	399.8	〃	178.59
-446	〃	445.7	〃	159.99	-495	〃	422.1	〃	169.05
-447	〃	470.5	〃	151.45	-496	〃	445.7	〃	159.99
-448	〃	496.8	〃	143.33	-497	〃	470.5	〃	151.45
-449	〃	524.6	〃	135.63	-498	〃	496.8	〃	143.33

Y2T TWO-TONE PROGRAMMİNG KITS

TWO-TONE CODE TABLE

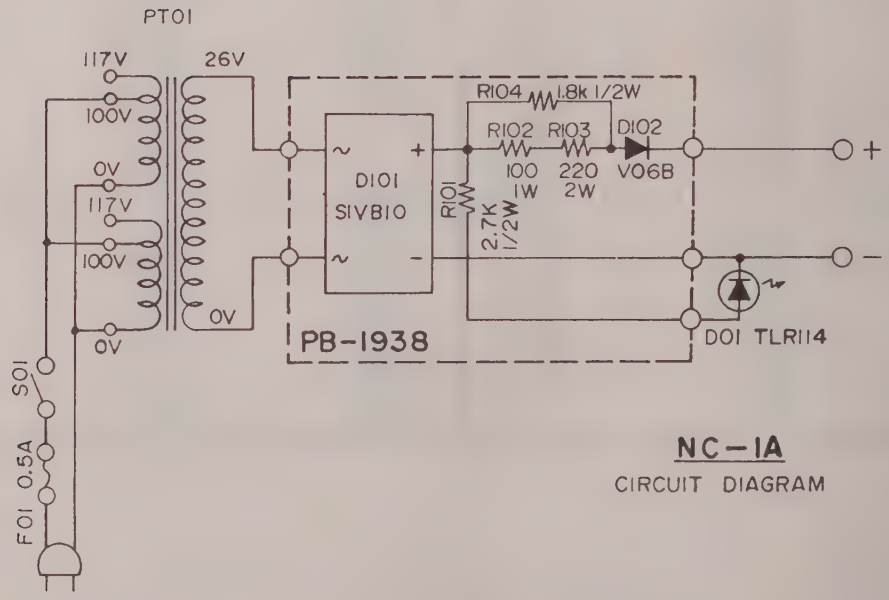
Y2T Kit Number:	Tone Pair:		Resistor Values (Note 1):		Y2T Kit Number:	Tone Pair:		Resistor Values (Note 1):	
	Tone A(Hz)	Tone B(Hz)	R 601 R 603 (KΩ)	R 602 R 604 (KΩ)		Tone A(Hz)	Tone B(Hz)	R 601 R 603 (KΩ)	R 602 R 604 (KΩ)
Y2T-501	553.9	584.8	128.35	121.46	Y2T-550	726.8	553.9	97.340	128.35
-502	〃	617.4	〃	114.94	-551	〃	584.8	〃	121.46
-503	〃	651.9	〃	108.75	-552	〃	617.4	〃	114.94
-504	〃	688.3	〃	102.90	-553	〃	651.9	〃	108.75
-505	〃	726.8	〃	97.340	-554	〃	688.3	〃	102.90
-506	〃	767.4	〃	92.084	-556	〃	767.4	〃	92.084
-507	〃	810.2	〃	87.114	-557	〃	810.2	〃	87.114
-508	〃	855.5	〃	82.395	-558	〃	855.5	〃	82.395
-509	〃	903.2	〃	77.938	-559	〃	903.2	〃	77.938
Y2T-510	584.8	553.9	121.46	128.35	Y2T-560	767.4	553.9	92.084	128.35
-512	〃	617.4	〃	114.94	-561	〃	584.8	〃	121.46
-513	〃	651.9	〃	108.75	-562	〃	617.4	〃	114.94
-514	〃	688.3	〃	102.90	-563	〃	651.9	〃	108.75
-515	〃	726.8	〃	97.340	-564	〃	688.3	〃	102.90
-516	〃	767.4	〃	92.084	-565	〃	726.8	〃	97.340
-517	〃	810.2	〃	87.114	-567	〃	810.2	〃	87.114
-518	〃	855.5	〃	82.395	-568	〃	855.5	〃	82.395
-519	〃	903.2	〃	77.938	-569	〃	903.2	〃	77.938
Y2T-520	617.4	553.9	114.94	128.35	Y2T-570	810.2	553.9	87.114	128.35
-521	〃	584.8	〃	121.46	-571	〃	584.8	〃	121.46
-523	〃	651.9	〃	108.75	-572	〃	617.4	〃	114.94
-524	〃	688.3	〃	102.90	-573	〃	651.9	〃	108.75
-525	〃	726.8	〃	97.340	-574	〃	688.3	〃	102.90
-526	〃	767.4	〃	92.084	-575	〃	726.8	〃	97.340
-527	〃	810.2	〃	87.114	-576	〃	767.4	〃	92.084
-528	〃	855.5	〃	82.395	-578	〃	855.5	〃	82.395
-529	〃	903.2	〃	77.938	-579	〃	903.2	〃	77.938
Y2T-530	651.9	553.9	108.75	128.35	Y2T-580	855.5	553.9	82.395	128.35
-531	〃	584.8	〃	121.46	-581	〃	584.8	〃	121.46
-532	〃	617.4	〃	114.94	-582	〃	617.4	〃	114.94
-534	〃	688.3	〃	102.90	-583	〃	651.9	〃	108.75
-535	〃	726.8	〃	97.340	-584	〃	688.3	〃	102.90
-536	〃	767.4	〃	92.084	-585	〃	726.8	〃	97.340
-537	〃	810.2	〃	87.114	-586	〃	767.4	〃	92.084
-538	〃	855.5	〃	82.395	-587	〃	810.2	〃	87.114
-539	〃	903.2	〃	77.938	-589	〃	903.2	〃	77.938
Y2T-540	688.3	553.9	102.90	128.35	Y2T-590	903.2	553.9	77.938	128.35
-541	〃	584.8	〃	121.46	-591	〃	584.8	〃	121.46
-542	〃	617.4	〃	114.94	-592	〃	617.4	〃	114.94
-543	〃	651.9	〃	108.75	-593	〃	651.9	〃	108.75
-545	〃	726.8	〃	97.340	-594	〃	688.3	〃	102.90
-546	〃	767.4	〃	92.084	-595	〃	726.8	〃	97.340
-547	〃	810.2	〃	87.114	-596	〃	767.4	〃	92.084
-548	〃	855.5	〃	82.395	-597	〃	810.2	〃	87.114
-549	〃	903.2	〃	77.938	-598	〃	855.5	〃	82.395



NOTE

1. ALL RESISTORS ARE IN 1/4w UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ARE IN μF.

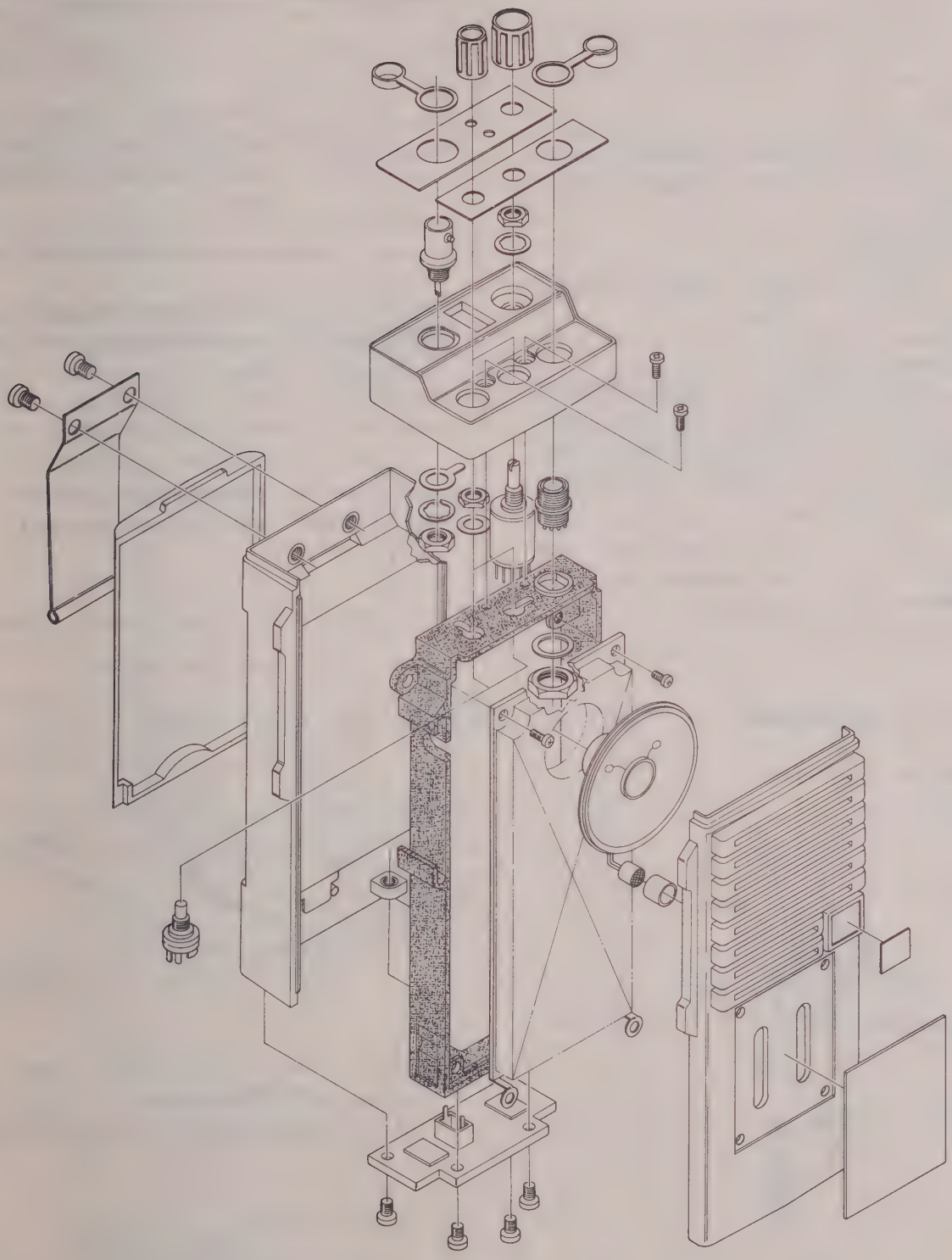
Quick Charger/AC Adapter NC-2



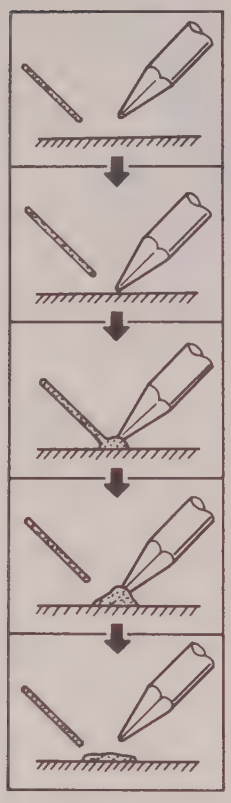
NC-1A
CIRCUIT DIAGRAM

Battery Charger NC-1A

FTC-2003 EXPLODED VIEW



BASIC SOLDERING PRACTICE



(1) Prepare soldering iron and solder.

(2) Apply soldering iron to surface to be soldered.

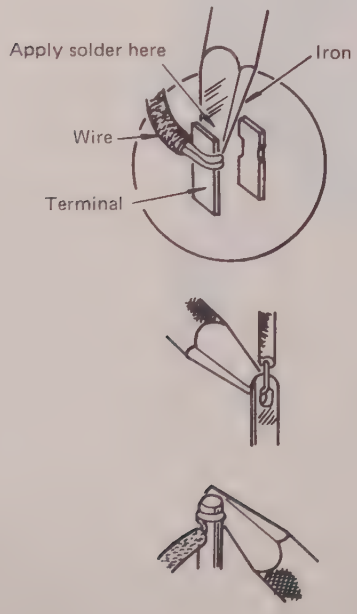
(3) Apply solder to heated surface.

(4) When enough solder is applied, remove solder. Continue to apply heat until solder flows cleanly.

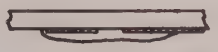
(5) Remove iron from work. Do not apply more heat than necessary for good solder flow.

Soldering to terminal posts:

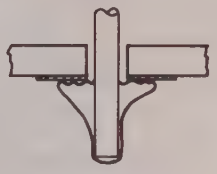
(Be certain to apply heat to both post and wire.)



EXAMPLES OF POOR SOLDERING PRACTICE



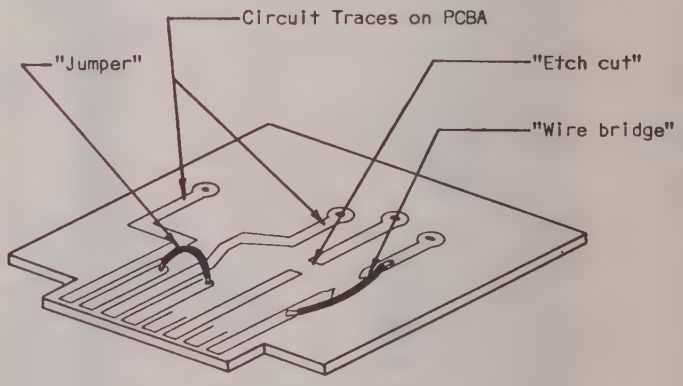
Solder bridge (caused by use of too much solder)

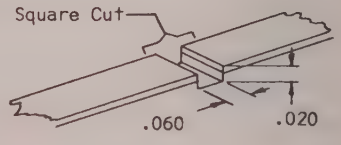


"Cold joint" (caused by insufficient heat to part of work, resulting in poor solder flow)

Lifted trace (caused by too much heat on circuit board foil)

Unstable joint (caused by insufficient heat or solder)





Coat Cut Area With Eastman 910

CIRCUIT TRACE REPAIR

The printed circuit boards used in the FTC-2003 are tough, but care should be exercised when performing repairs. The circuit traces frequently run close together, and solder bridges are easily formed if a dirty soldering iron is used.

A few simple precautions will keep the FTC-2003 circuit boards in A-1 condition:

1. Use only a 12 to 30 watt chisel-tip soldering iron, with the smaller sizes preferred.

2. Use only a soldering iron equipped with a three-wire cord, with the tip grounded. Also acceptable is a soldering iron isolated through a transformer. An old soldering iron or gun may have 117 volts on the tip, and will certainly cause more damage than it repairs!

3. Use only 60/40 rosin core solder. Acid core solder has no place in a radio shop.

4. Use a solder sucker and solder tape to ensure a professional repair job.

Occasionally, etch cuts and jumper wires may be noted on a circuit board. This sort of modification, while uncommon, typically reflects a factory fine tuning of a design that was too insignificant to warrant a redo of the circuit board. If you encounter such mods, please leave them in place.

If you have previously lifted a copper trace, don't worry! Refer to the drawing, and make an etch cut on either side of the lifted trace. Now install a wire bridge to replace the exorcised trace. The circuit will now be "good as new," and servicing can continue with minimal interruption.

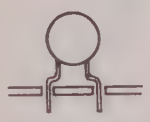
INSERTION OF PARTS ON CIRCUIT BOARDS

All of the below are acceptable ways of inserting components into circuit board mounting holes.

(a) Bend leads slightly

(b) Straight-in mounting

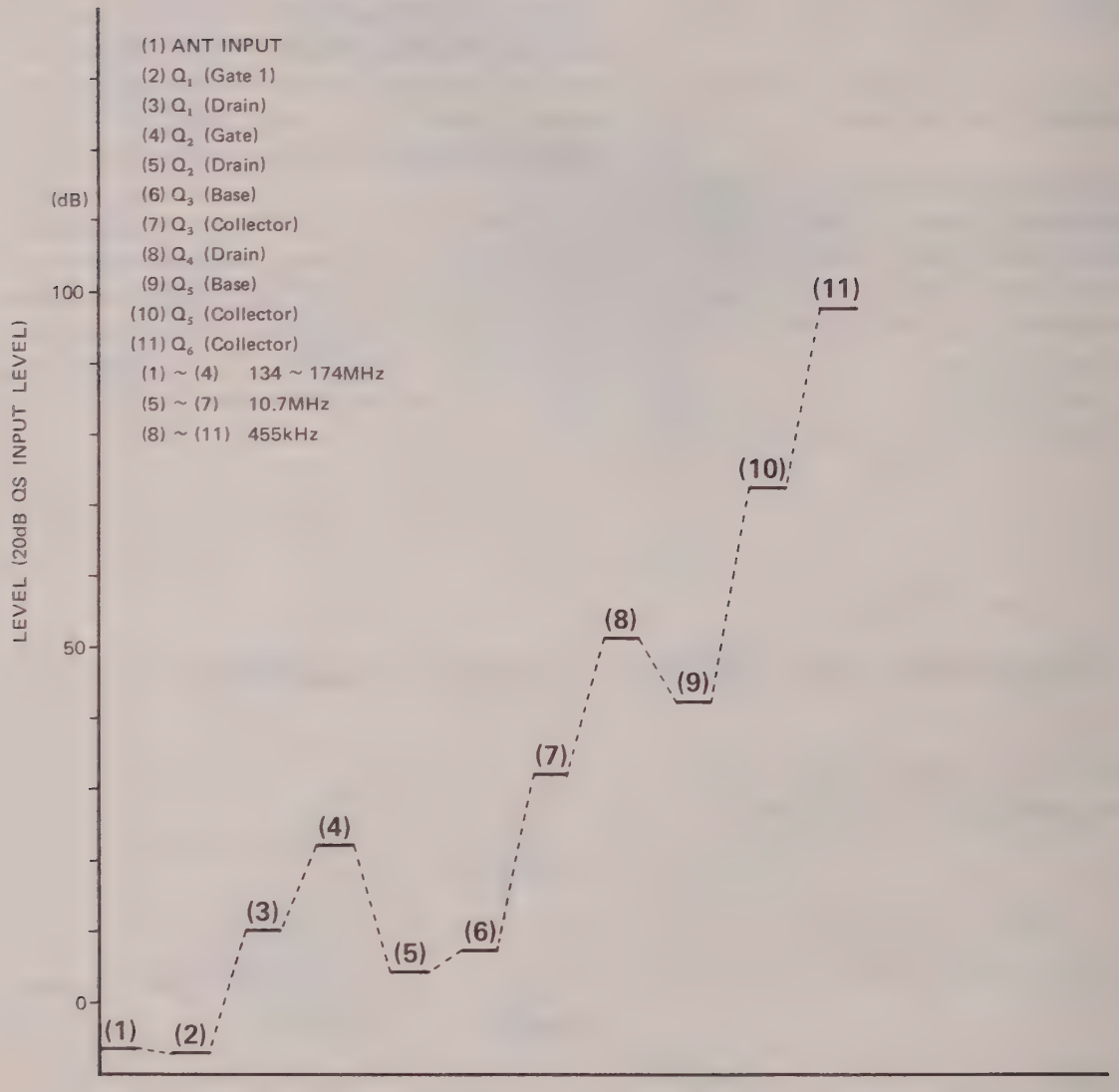
(c) Vertical mounting



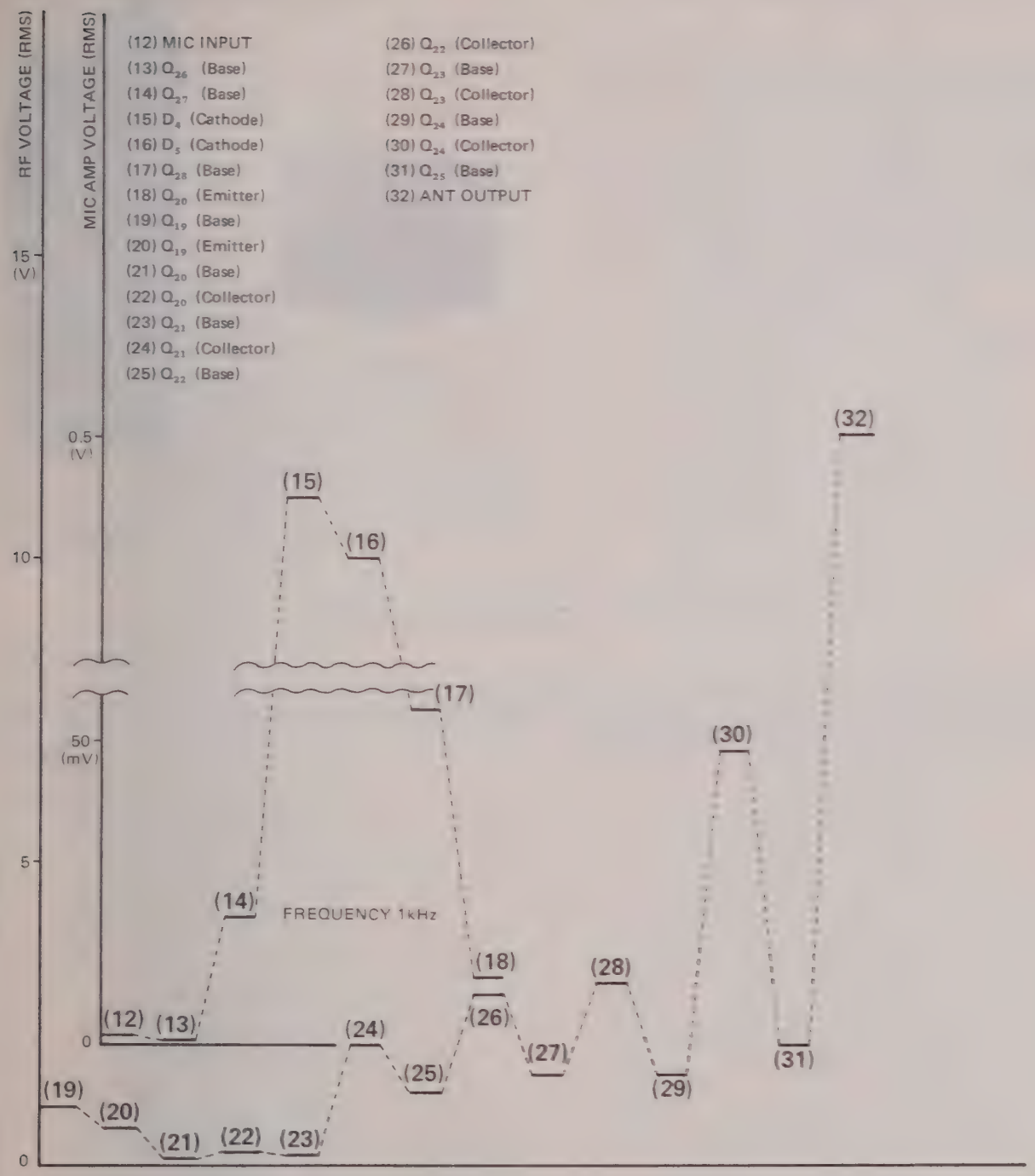
(d) Preformed disc ceramic capacitor

(e) Preformed resistor, diode, etc.

LEVEL DIAGRAM : RECEIVER SECTION



LEVEL DIAGRAM : TRANSMITTER SECTION



REMOVAL OF TRANSCEIVER CASE

(1) Remove screws A and B in Fig. 12, using a Phillips screwdriver of the proper size. Carefully remove the back panel of the transceiver.

(2) Remove screws C and D in Fig. 13. The front panel may now be carefully removed. Be certain not to put undue strain on the interconnection wires.

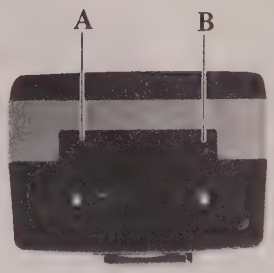


Fig. 12

Fig. 13

FTC-2003 VOLTAGE CHART

COMPONENT	B (G)	E (S)	C (D)	COMMENTS	COMPONENT	B (G)	E (S)	C (D)	COMMENTS
Q_1	G_1 0 G_2 4.8V	0.5V	10.3V	RX SQ.OFF	Q_{18}	5.2	5.8	0	RX SQ OFF
Q_2	0	2.0	9.7	"	Q_{19}	2.0	1.8	4.3	TX PTT ON
Q_3	2.3	1.8	9.8	"	Q_{20}	1.6	1.1	3.7	"
Q_4	0	2.0	9.0	"	Q_{21}	0.9	0.4	4.9	"
Q_5	1.0	0	1.2	"	Q_{22}	0	1.1	9.5	"
Q_6	4.9	4.8	5.8	"	Q_{23}	0	1.5	9.6	"
Q_7	0.7	0	1.1	"	Q_{24}	–0.2	0	10.6	"
Q_8	4.3	5.8	5.8	"	Q_{25}	–0.22	0	10.6	"
Q_9	–0.1	0	2.8	"	Q_{26}	0.6	0	0.8	"
Q_{10}	2.2	2.0	9.0	"	Q_{27}	2.6	2.0	2.9	"
Q_{11}	1.8	1.7	3.0	"	Q_{28}	0.8	0.17	1.65	"
Q_{12}	0.8	0	2.0	"	Q_{29}	10.7/0.75	10.0/0.2	10.8/10.7	PTT OFF/ON
Q_{13}	10.7/10.7	0/9.0	10.7/10.4	SQ OFF/ON	Q_{30}	10.8/10.0	10.8/10.7	0/10.6	"
Q_{14}	0	0	9.0	RX SQ OFF	Q_{301}	0/0.65	0/0	2.65/0.03	SQ OFF/ON
Q_{15}	6.0/0	7.0/0.5	10.0/0	SQ OFF/ON	Q_{302}	2.6/0.03	1.92/0	1.97/10.2	"
Q_{16}	9.5/10	10.0/10.8	6.0/0	"	Q_{303}	0.57/10.8	0.26/10.5	10.8/10.8	TONE OFF/ON
Q_{17}	6.0/0	5.8/0	10.8/10.8	"					SW ON/ SW OFF

Measured with VTVM

MAINTENANCE AND SERVICING

REGULAR MAINTENANCE PLAN

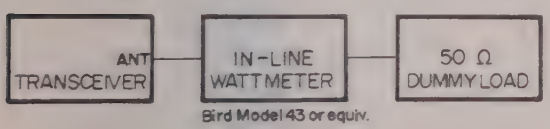
Because of the rugged design and construction of the FTC-2003, little maintenance should be required if the radio is not abused. As a Yaesu dealer, though, you are best in a position to determine the individual needs of your customers. Operation in extremely harsh environments may warrant more frequent checks of transceiver performance.

We recommend that customers return their sets to your service facility once every two years for routine checks of the transmitter power output and the receiver sensitivity. In the meantime, keep in frequent touch with your customers regarding their expanding communications requirements. Not only will this give you the opportunity to introduce new Yaesu products, but your customers' particular service requirements will become evident.

PERFORMANCE CHECKS

Set up the FTC-2003 and test equipment as follows:

I. Transmitter Power Output
   a) Connect a suitable low power VHF dummy load/wattmeter to the antenna jack.
   b) Connect a 10.8 volt DC power source to the bottom panel EXT jack. Alternatively, use a freshly-charged battery pack or insert the FTC-2003 into the NC-2 Quick Charger/AC Adapter (AC Adapter mode).
   c) Set the channel selector to any channel. Close the push-to-talk switch, and observe the power output. The output should be at least three watts, assuming a 50 ohm resistive load.



PO Test Setup

II. Receiver Sensitivity
   a) Connect an audio voltmeter to pin 2 of the top panel MIC jack. Pin 2 is the external speaker connection. Set the squelch control fully counterclockwise.
   b) Connect the RF output of a precision VHF signal generator to the antenna jack, and note the audio voltmeter reading with no signal input from the signal generator. Adjust the volume control and voltmeter range, as necessary, to obtain roughly a full-scale reading.
   c) Set the signal generator to the receiving channel frequency, and adjust the output amplitude of the signal generator until the voltmeter indicates a 20 dB decrease (1/10th voltage) of the reading in step b). The signal generator output voltage at this point is the 20 dB quieting sensitivity, and it should be approximately 0.3 μV.

RX Sensitivity Test Setup

If the above checks are both OK, then clean out the transceiver by applying moderate-force compressed air throughout the chassis area. This will remove any dust that is present. If there is accumulated dirt inside the cabinet, a soft brush may be used to loosen it. Wipe the outer cabinet of the transceiver with a damp cloth, and used compressed air to dislodge accumulated dust present in the corners of the radio.

Do not use cleaning fluid on the cabinet of the FTC-2003. The ABS plastic may be partially dissolved by the chemicals present in the cleaning fluid.

RECEIVER ALIGNMENT

(1) Local Oscillator

Connect the RF probe of a VTVM to the source of Q_2. Adjust the cores of T_8 and T_9 for maximum indication on the VTVM.

(2) Receive Channel Alignment

Connect a precision frequency counter to the emitter of Q_{10}, through a 10 pF capacitor. Adjust TC_1 for channel A, TC_2 for channel B, TC_3 for channel C, TC_{301} for channel D, TC_{302} for channel E, and TC_{303} for channel F, for the precise channel frequency as determined by the following formula:

$$\text{Crystal freq.} = \frac{\text{Operating freq.} - 10.7}{9} \text{ MHz.}$$

TC_1 –TC_3 are located on the MAIN board, while TC_{301} –TC_{303} are located on the BUSY board.

(3) 10.7 MHz IF Transformer Alignment (I)

Connect a sweep generator with a center frequency of 10.7 MHz to the source of Q_2, and connect the diode detector of an oscilloscope to the emitter of Q_3. Adjust T_5 and T_6 until the pattern shown in Figure 14 is obtained.

(4) RF Amplifier Resonator

Connect a VHF signal generator to the antenna jack, and set its output to a channel near the center of the transceiver operating range. Connect an audio millivoltmeter to pin 2 of the MIC jack (speaker output). Use an attenuator in the line from the signal generator, if required.

Inject a 70 dB signal from the generator, and adjust the attenuator and voltmeter range, in order to make it possible to note changes in the quieting level of the receiver. Now adjust T_1 through T_4 for maximum quieting on the input signal.

If you have no audio voltmeter, inject a 1 kHz 60% modulated RF signal from the signal generator. Adjust T_1 through T_4 by ear for minimum background noise and best clarity on the input tone from the generator. Adjust the attenuation level as necessary to provide meaningful observation of changes in transformer tuning.

(5) 10.7 MHz IF Transformer Alignment (II)

Leave the audio voltmeter and signal generator connected as in step (4). Inject a signal near the noise floor from the signal generator, and adjust T_7 for maximum quieting on the input signal. This adjustment may also be done by ear, if no audio voltmeter is available.

(6) Tone Squelch (Option) Setting

Set the SQL control to the TONE position. Connect a precision VHF signal generator to the antenna jack, and set its output to any channel. Inject a 0.25 μV signal, and adjust VR_{301} until the squelch just opens (BUSY LED becomes illuminated).

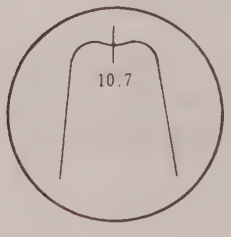
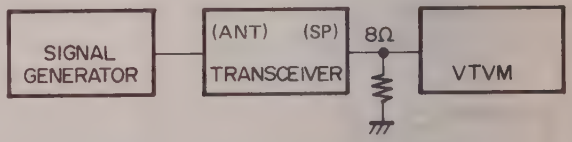
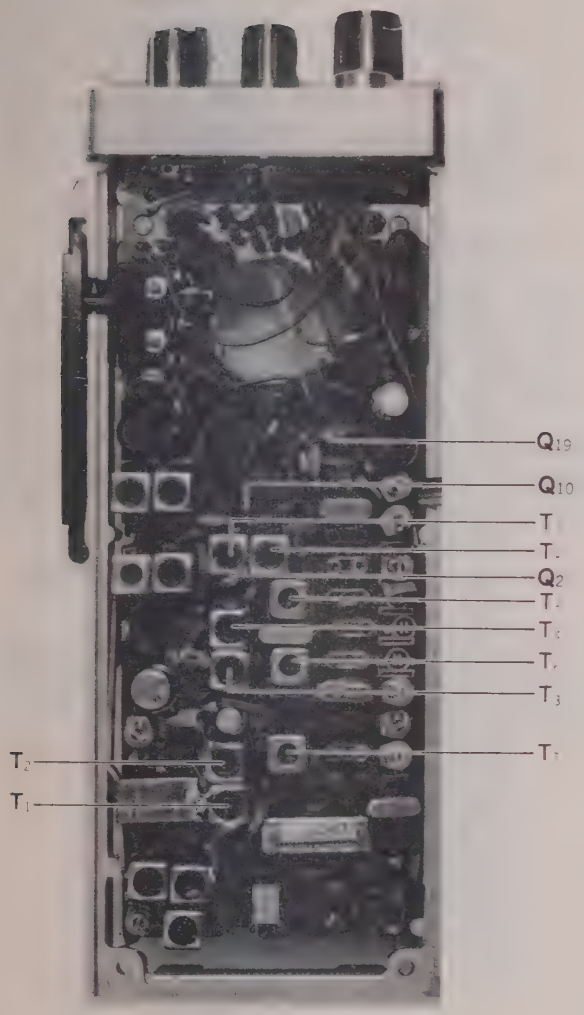


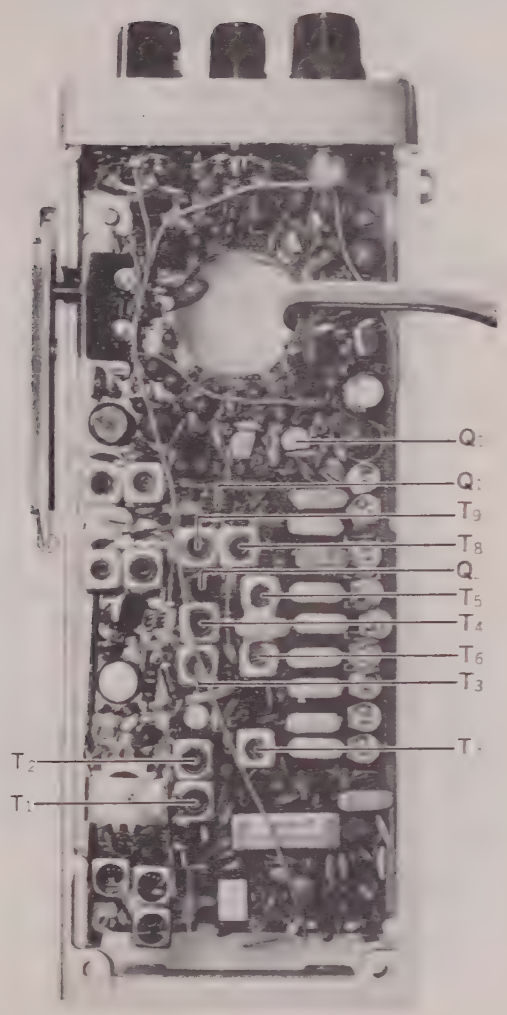
Fig. 14

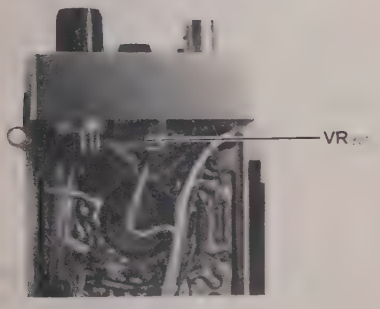


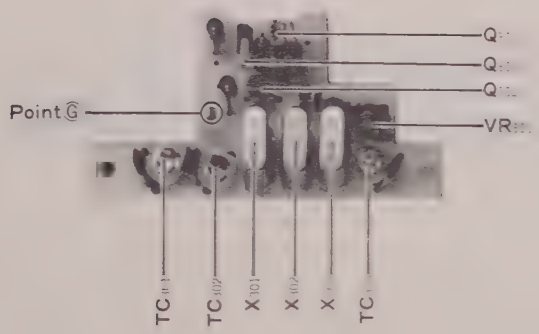
3 Channel Version

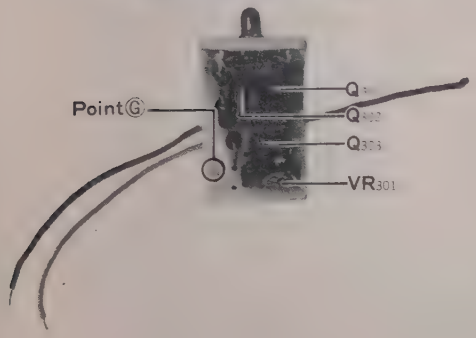


6 Channel Version









Alignment Points

TRANSMITTER ALIGNMENT

Make all transmitter adjustments with a 50 ohm dummy load/wattmeter connected to the antenna jack.

(1) Multiplier Stage Adjustment

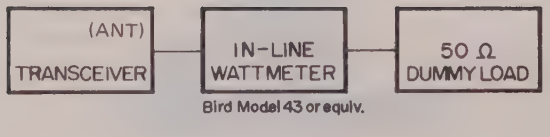
a) Connect a DC voltmeter to the emitter of Q_{22}. While transmitting, adjust T_{10} and T_{11} for a maximum reading on the voltmeter. A nominal reading is 1 VDC.

b) Connect the DC voltmeter to the emitter of Q_{23}. Adjust T_{12} and T_{13} for a maximum reading on the voltmeter. A nominal reading is 1.5 VDC.

c) Connect the RF probe of a VTVM to the base of Q_{24}. Compress or spread open **slightly** the turns of L_2 and L_3 to secure a maximum reading on the VTVM. This adjustment is fairly critical, so do not make any major adjustment unless the coils are being replaced for some reason.

(2) RF Output Peaking

Adjust TC_7 and TC_8 while transmitting for a maximum indication on the dummy load/wattmeter. With a full battery charge, power output should be approximately 3 watts.



(3) Deviation Adjustment

Connect a deviation meter to the antenna jack, and connect an audio signal generator to the microphone input terminal, as shown in Figure 15. Apply a 1 kHz modulated 15 mV signal, and adjust VR_1 for a deviation of ±4.7 kHz as shown on the deviation meter.

(4) TX Frequency Adjustment

Connect a precision frequency counter, through a 10 pF capacitor, to the emitter of Q_{19}. Adjust TC_4 for channel A, TC_5 for channel B, TC_6 for channel C, TC_9 for channel D, TC_{10} for channel E, and TC_{11} for channel F, to provide a correct frequency indication on the counter. The crystal frequencies should be determined by the formula

$$\text{Crystal frequency} = \frac{\text{Operating frequency}}{12} \text{ MHz}$$

If a precision VHF frequency counter is available, the frequency may be read directly by coupling loosely to the antenna or dummy load.

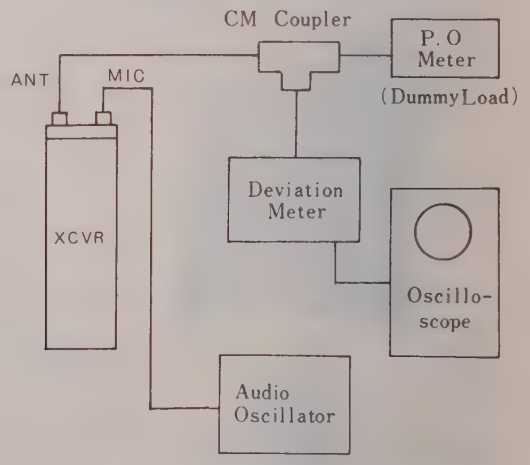
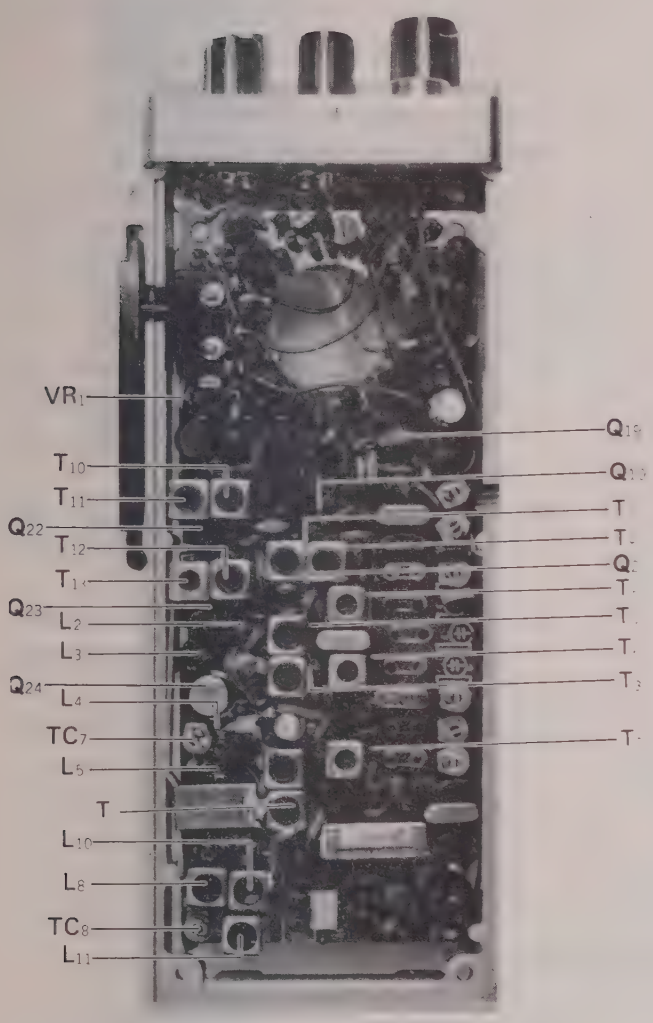
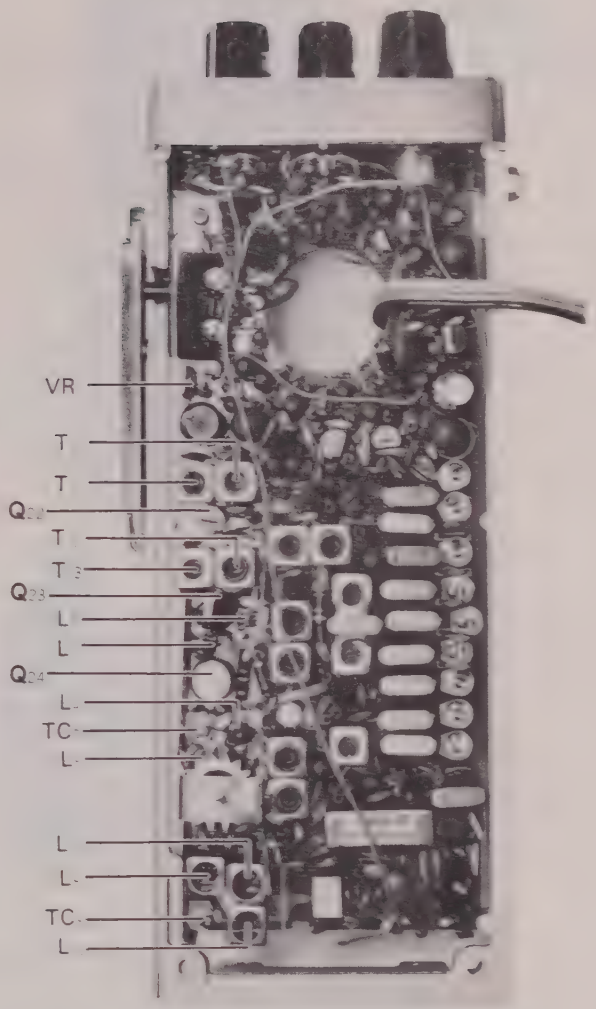


Fig. 15

3 Channel Version



6 Channel Version



Alignment Points

CHANNEL CHANGES

I. Channel Changes within Present 4 MHz Operating Range

Channel changes within the existing 4 MHz range of the transceiver are easy to perform.

a) Insert the desired crystals (See Table 1, page 2-3 for crystal specifications) into the correct sockets, as detailed in Figure 16.

b) To net the receive channels, connect a precision frequency counter to the emitter of Q_{10}, through a 10 pF capacitor. Adjust $TC_1 - _3$ or $TC_{301} - _{303}$ for channels A–C or D–F, respectively, to set the crystals to the frequency determined by the following formula:

$$\text{Crystal freq.} = \frac{\text{Operating freq.} - 10.7}{9}\text{MHz.}$$

c) To net the transmit channels, connect the frequency counter to the emitter of Q_{19}, through a 10 pF capacitor. Adjust $TC_4 - _6$ or $TC_9 - _{11}$ for channels A–C or D–F, respectively, to set the crystals to the frequency determined by the following formula:

$$\text{Crystal freq.} = \frac{\text{Operating freq.}}{12}\text{MHz.}$$

Alternatively, use a 1 turn loop on the counter probe, and couple it lightly to the coaxial cable to the dummy load. The frequency may then be read directly, so long as the counter is capable of sufficient accuracy.

II. Channel Modifications to a New 4 MHz Range

If a new 4 MHz range is required (within the existing 134–154 MHz, 142–164 MHz, or 152–174 MHz range), proceed as follows:

a) Insert the new crystals into the appropriate sockets.

b) Set the receive crystals precisely to the correct frequency, as shown in section I-b, above.

c) Perform an alignment of the receiver strip, as detailed on page 3-8.

d) Set the transmit crystals precisely to the correct frequency, as shown in step I-c, above.

e) Perform an alignment of the transmitter strip, as detailed on page 3-10.

III. Channel Modifications Involving Major Frequency Change

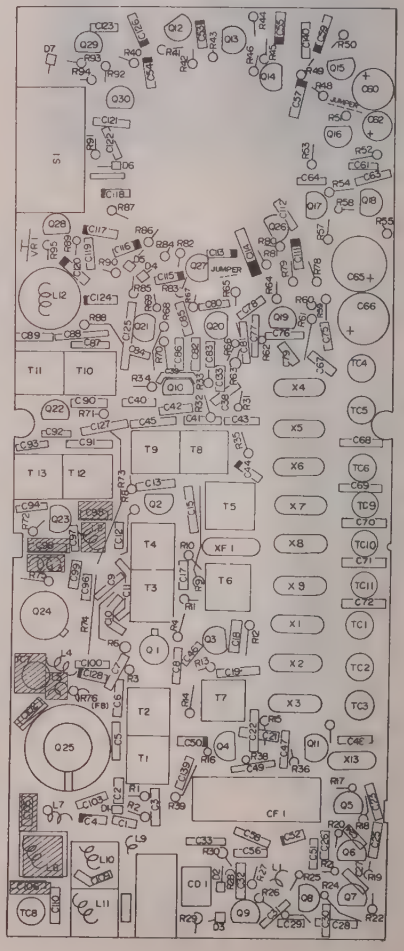
The FTC-2003 comes equipped for operation on one of the following three bands: 134–153 MHz; 142–164 MHz; 152–174 MHz. To make a channel change involving an entirely new frequency range, proceed as follows:

a) Refer to Table 5, and change the five or six capacitors shown therein. Frequency range modification kits are available from Yaesu.

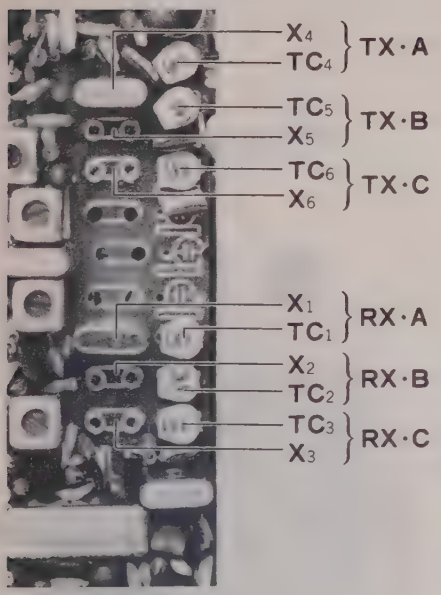
b) Now insert the desired crystals into the appropriate sockets, as shown in Figure 16.

c) Align the receiver and transmitter strips, setting the receive and transmit channel crystals on frequency as you go.

d) Remember that all channels must fall within a 4 MHz range.



3 Channel Version



6 Channel Version

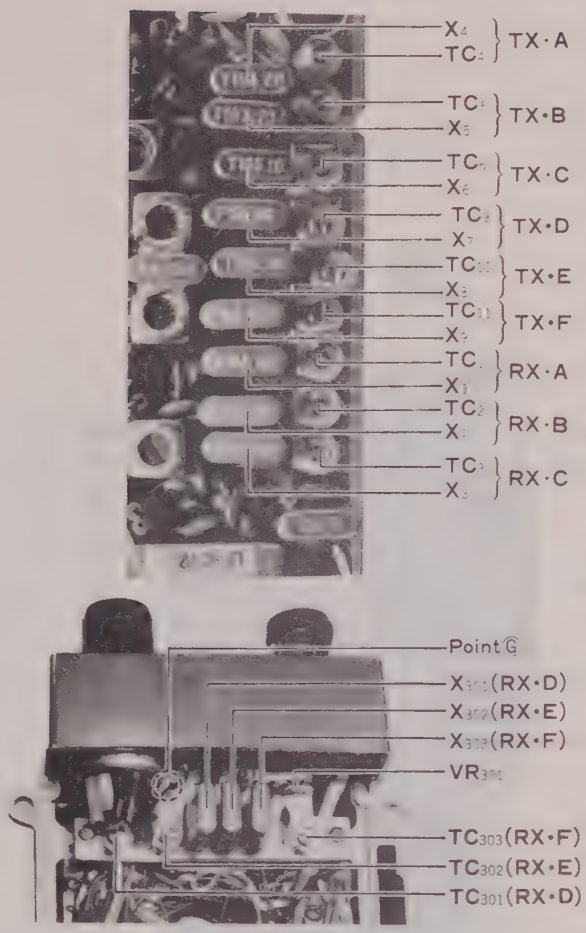


Fig. 16

FREQUENCY RANGE CONVERSION TABLE

FREQUENCY RANGE		L_2	L_3	L_5	L_8	C_{95}	C_{98}	C_{102}	C_{105}	C_{106}	C_{144}
BAND A 132 ~ 154 MHz	L (134 MHz)	B	B	A	A	33pF	27pF	27pF	39pF	39pF	3pF
	M (146 MHz)	C	C	A	F						
	H (154 MHz)	D	D	A	E						
BAND B 142 ~ 164 MHz	L (142 MHz)	B	B	A	F	27pF	22pF	22pF	39pF	33pF	–
	M (152 MHz)	C	C	A	E						
	H (164 MHz)	D	D	A	E						
BAND C 152 ~ 174 MHz	L (152 MHz)	B	B	B	F	22pF	15pF	15pF	33pF	33pF	–
	M (164 MHz)	C	C	B	E						
	H (174 MHz)	D	D	B	E						

A Close spaced

B Turns slightly spread

C Turns moderately spread

D Turns fairly wide spaced

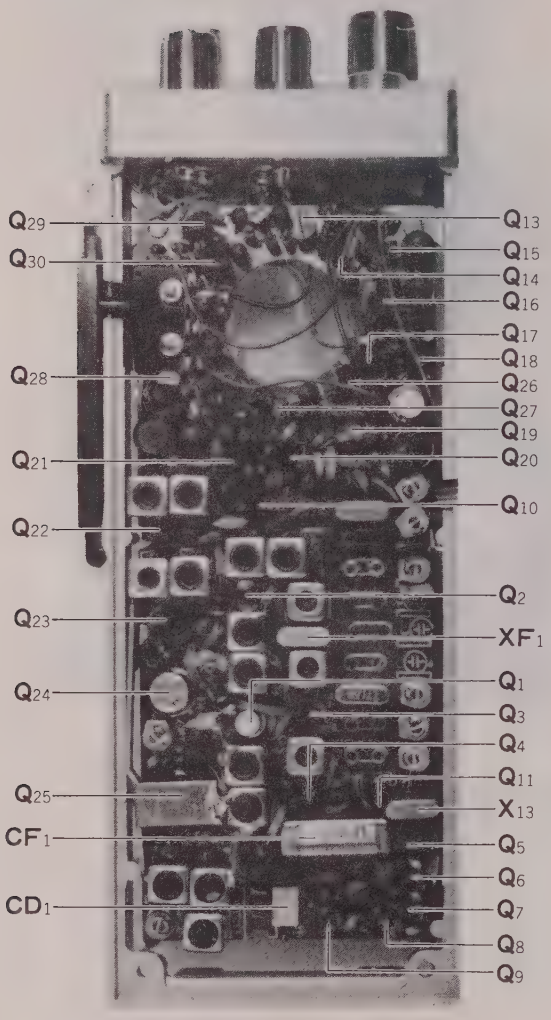
E Turns wide spaced

F Half close spaced, half wide spaced at angle

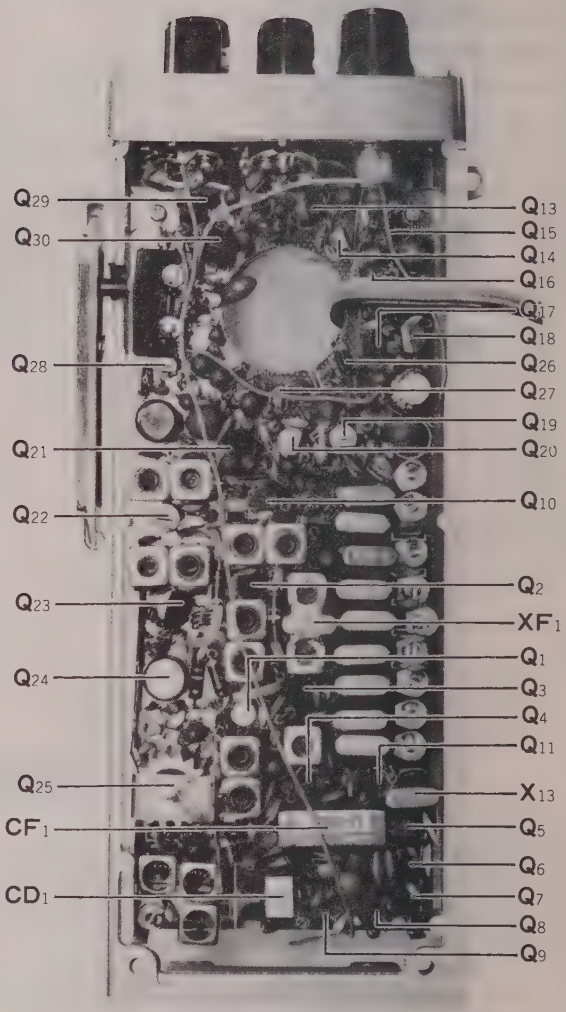
L_2, L_3, L_5, L_8 Turn spacing code

PARTS LAYOUT
MAIN BOARD COMPONENT SIDE VIEW

3 Channel Model



6 Channel Model



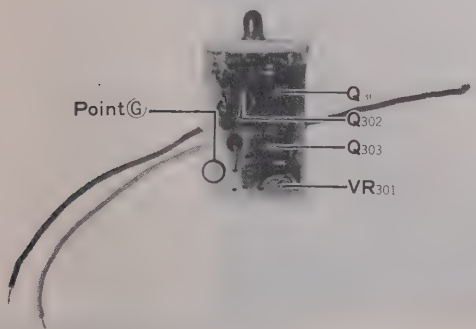
MAIN BOARD SOLDER SIDE VIEW

3 Channel Model

6 Channel Model

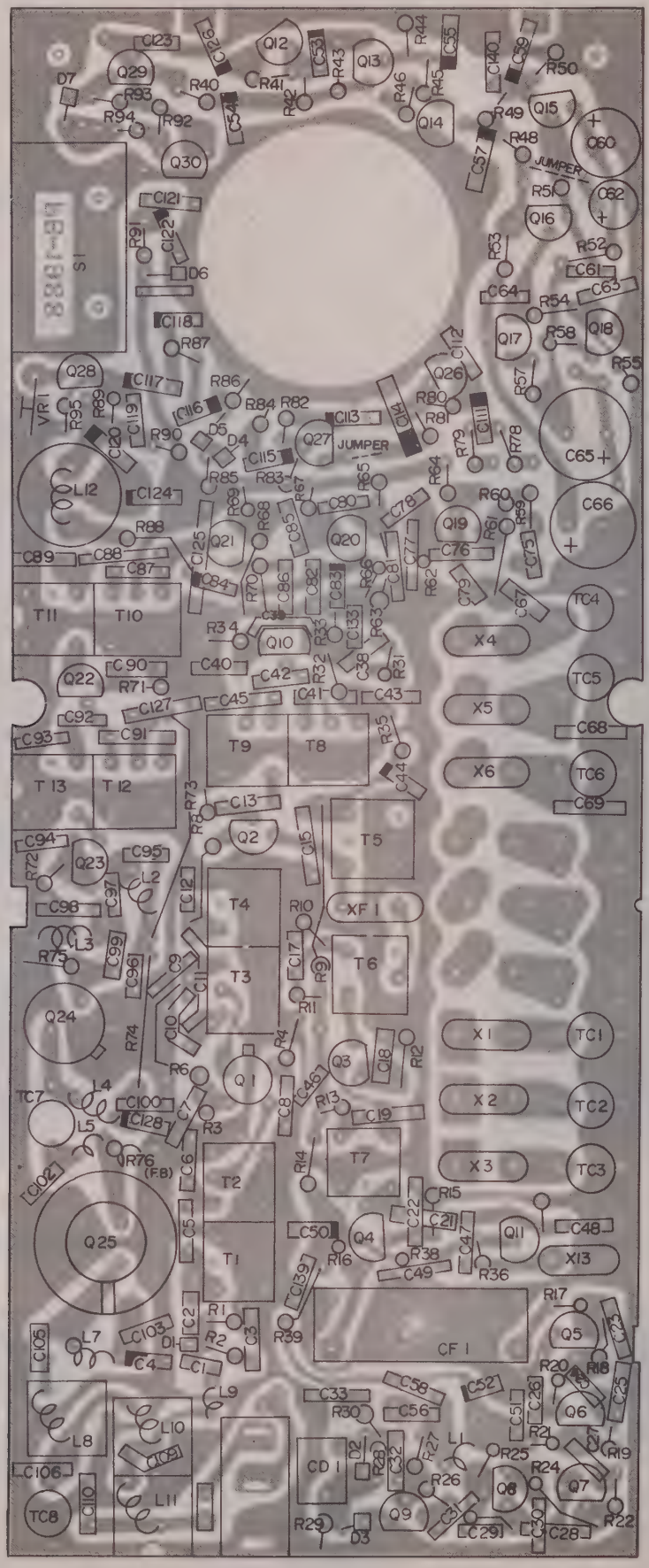
LED/BUSY BOARD

3 Channel Model



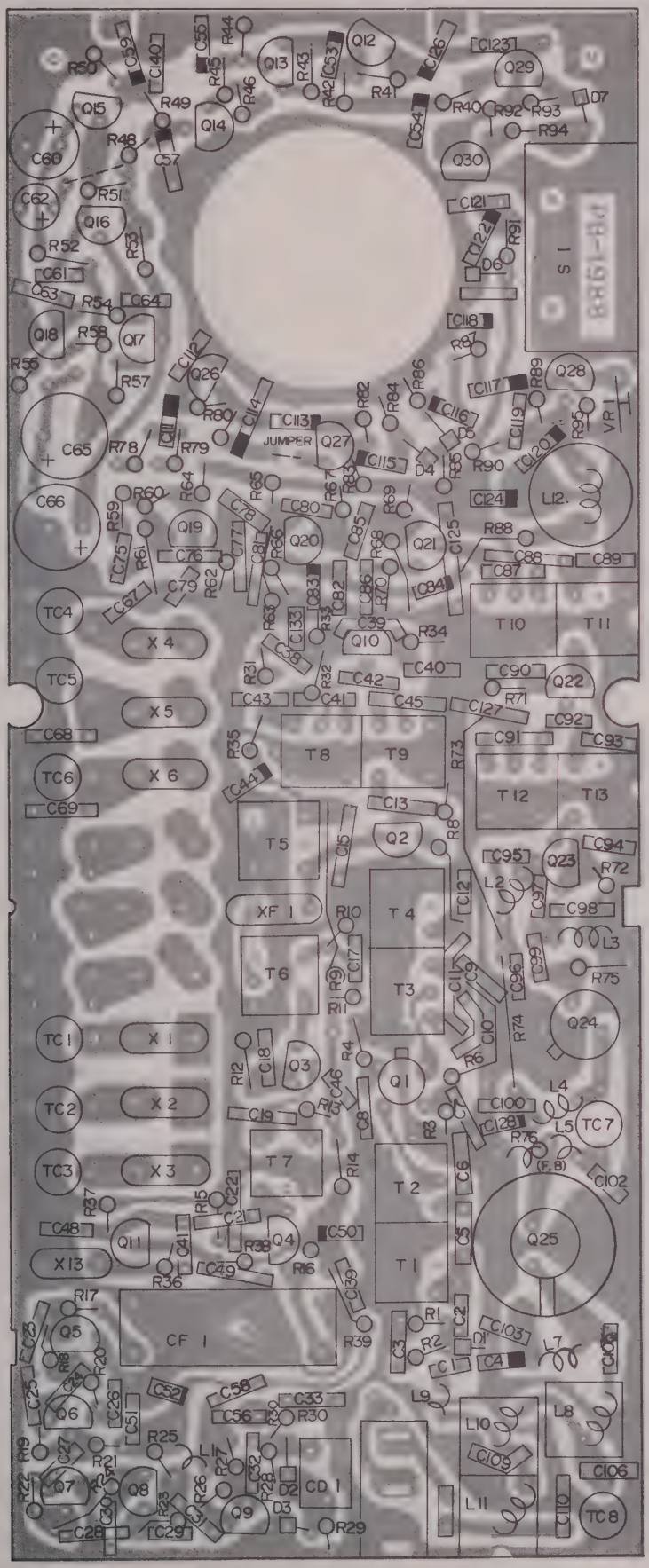
6 Channel Model

MAIN BOARD PARTS LAYOUT (3 CHANNEL MODEL)



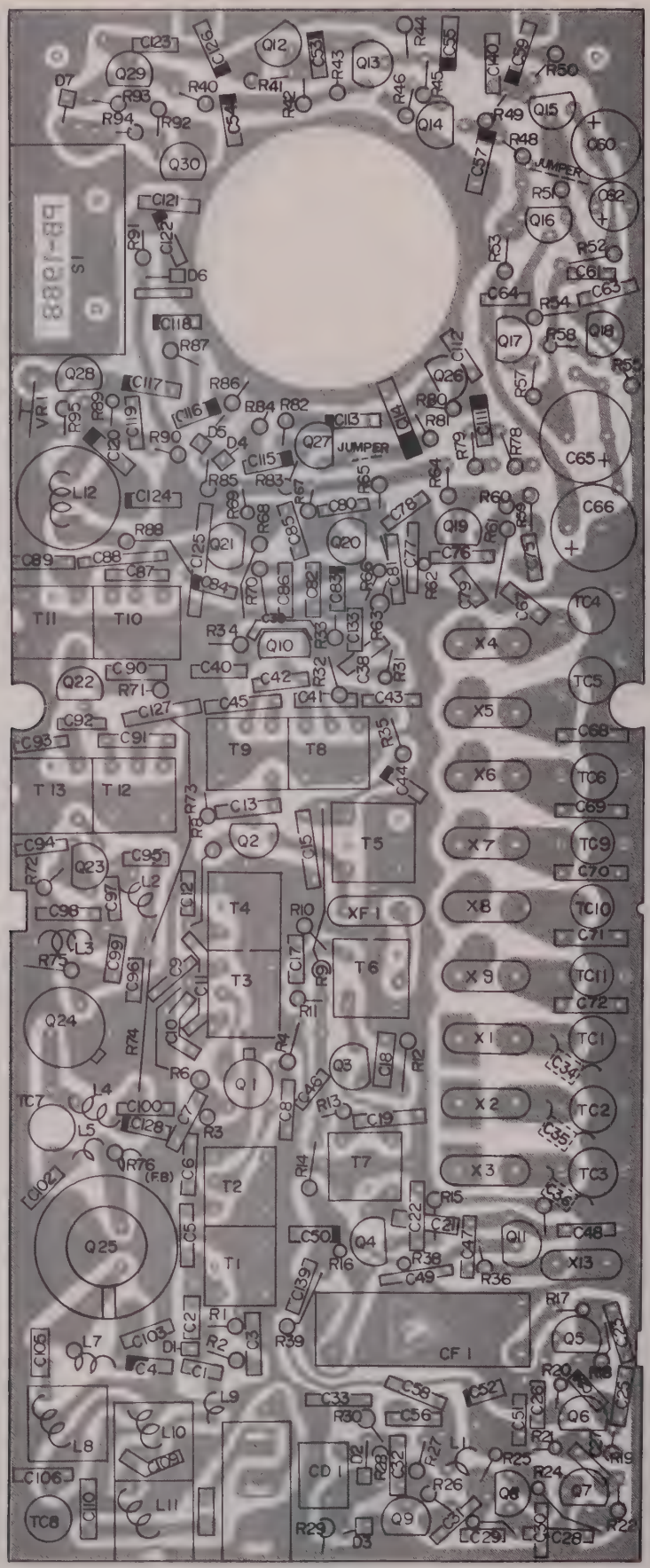
Viewed from Component Side

MAIN BOARD PARTS LAYOUT (3 CHANNEL MODEL)



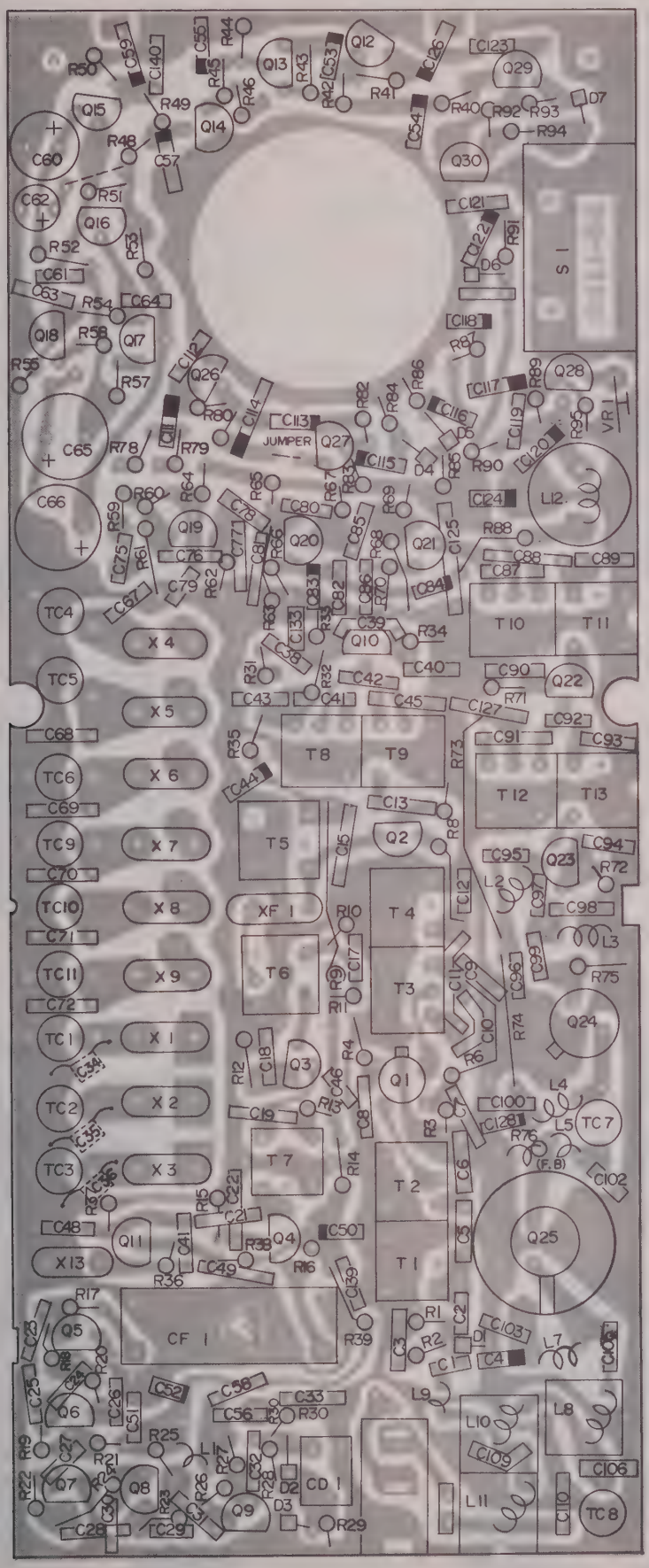
Viewed from Solder Side

MAIN BOARD PARTS LAYOUT (6 CHANNEL MODEL)



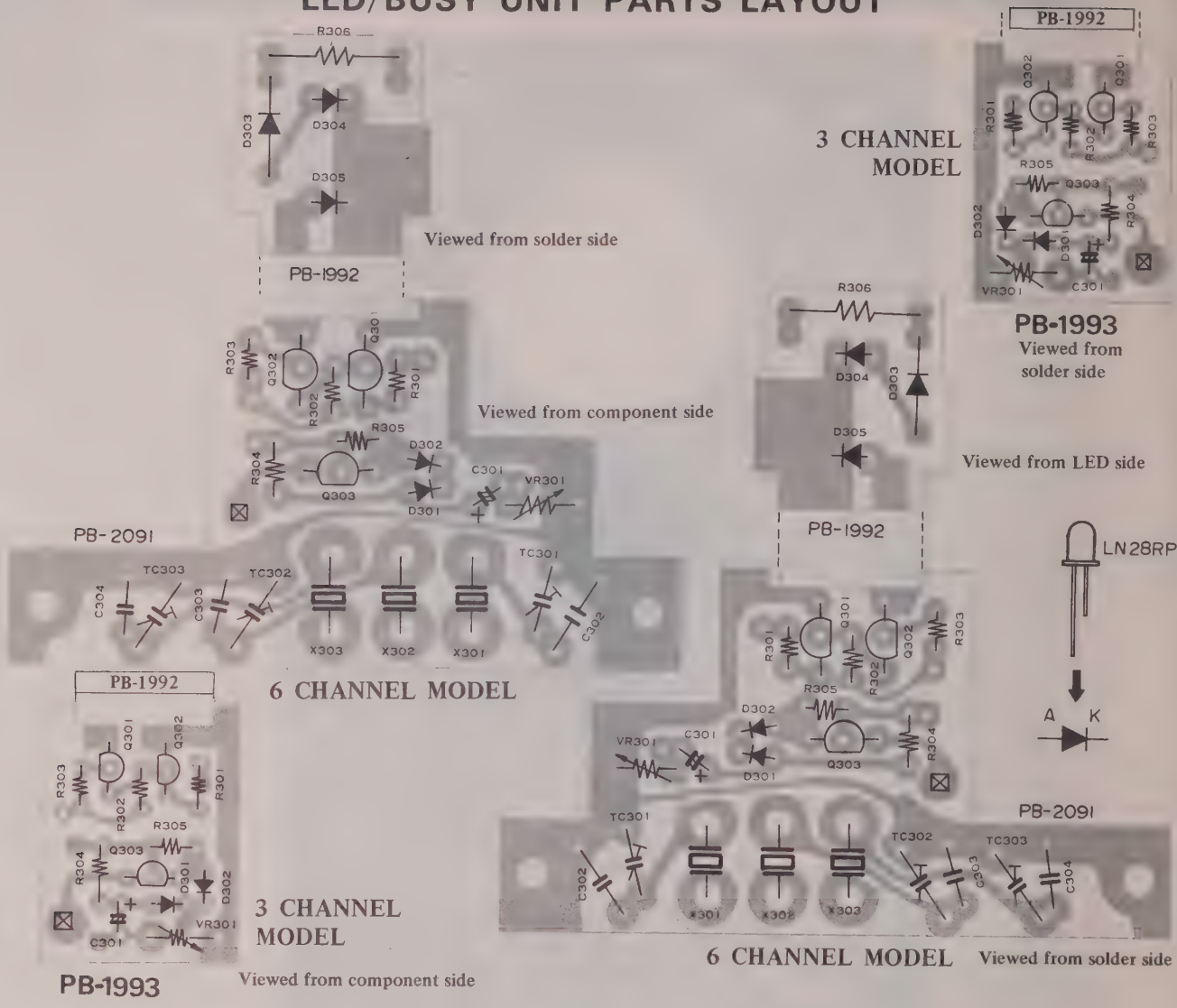
Viewed from Component Side

MAIN BOARD PARTS LAYOUT (6 CHANNEL MODEL)



Viewed from Solder Side

LED/BUSY UNIT PARTS LAYOUT

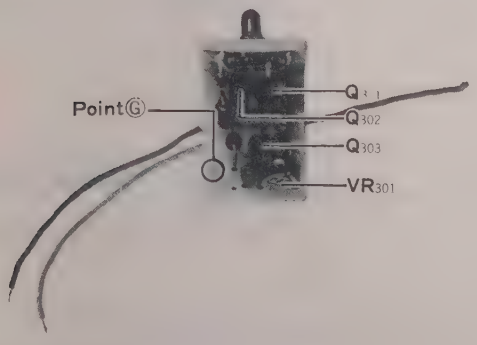


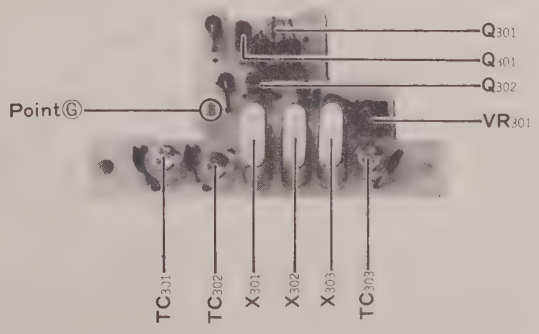
TONE SQUELCH UNIT PARTS LAYOUT

TWO TONE DECODER UNIT PARTS LAYOUT

TYPICAL PART FAILURES, CAUSES, AND SYMPTOMS

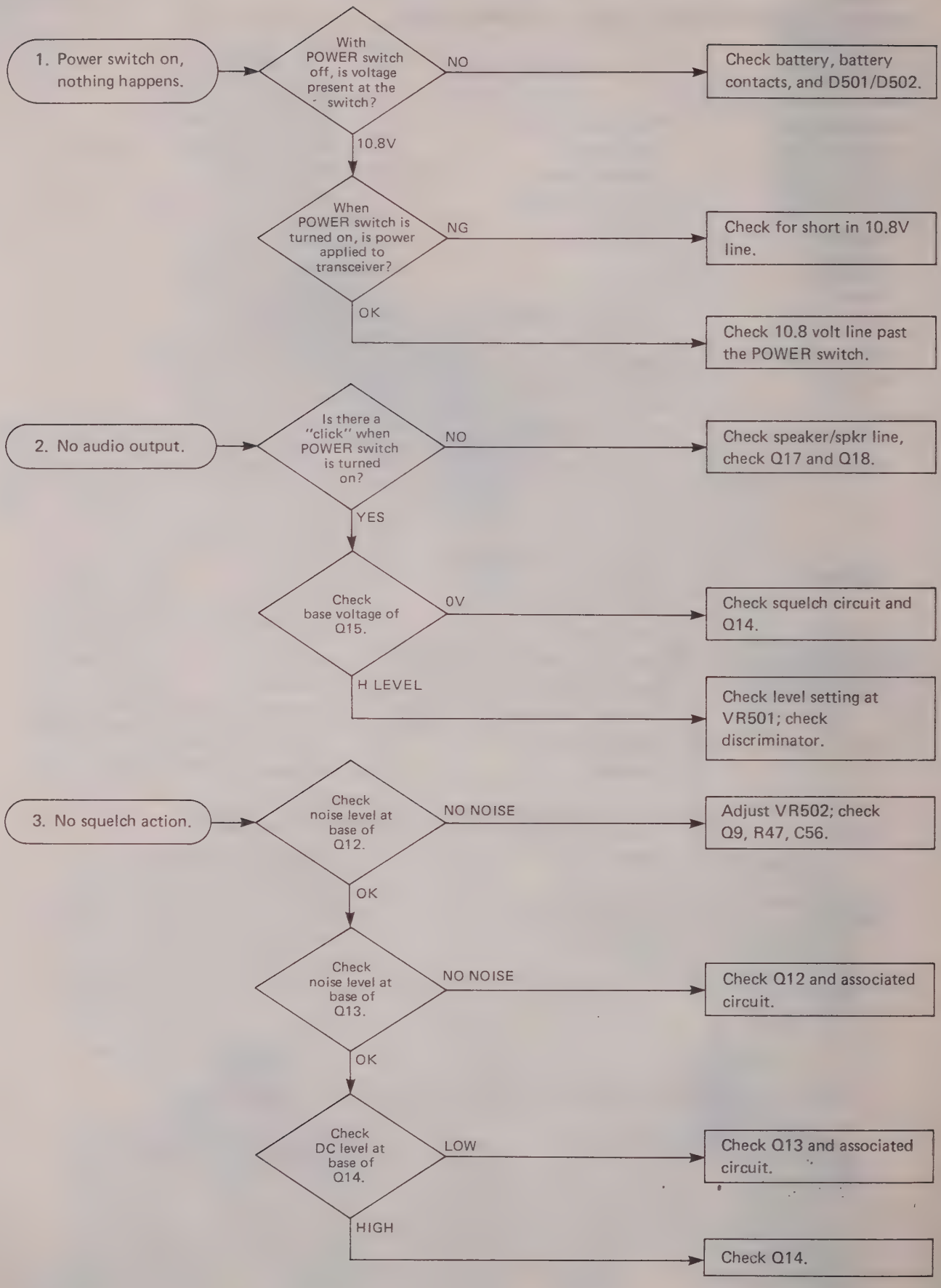
PARTS	CAUSE OF TROUBLE	SYMPTOMS
Semiconductors (IC, FET, TR)	High supply voltage Open circuit Excessive drive High temperature	Short or open circuit Output decreases to 1/2 at 80°C Internal noise Instability
MOS FET MOS IC	Static electricity	Total failure
Crystal Crystal filter	Shock High temperature	Crystal destroyed Frequency drift Filter bandpass change
Resistor	Excessive power Aging High temperature	Component burned Value changed Open circuit
Potentiometer	Excessive power Shock	Component burned Open circuit Noise Unsmooth rotation
Capacitor	Excess voltage High temperature Excess power	Shorted Leakage Open/decreased capacitance
Variable capacitor Trimmer capacitor	Ratings exceeded Dust between plates Shock, forced rotation	Shorted Leakage Unsmooth rotation
Coils	Ratings exceeded Variation	Open or short circuit Leakage or shorted turns Detuned
Switch	Ratings exceeded Aging	Poor contact Unsmooth operation Open circuit
Relay	Ratings exceeded Humidity	Poor contact Noise Coil open

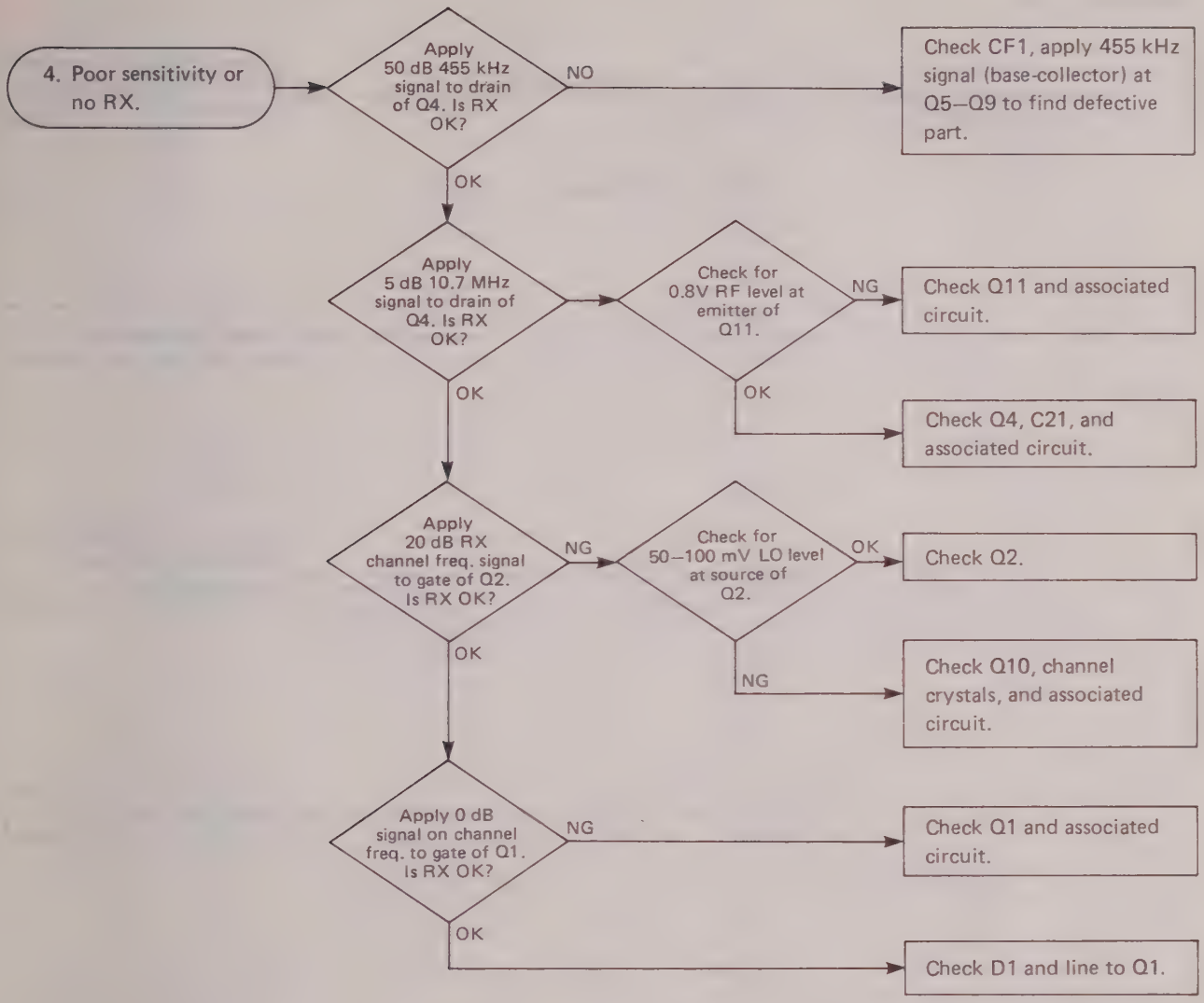




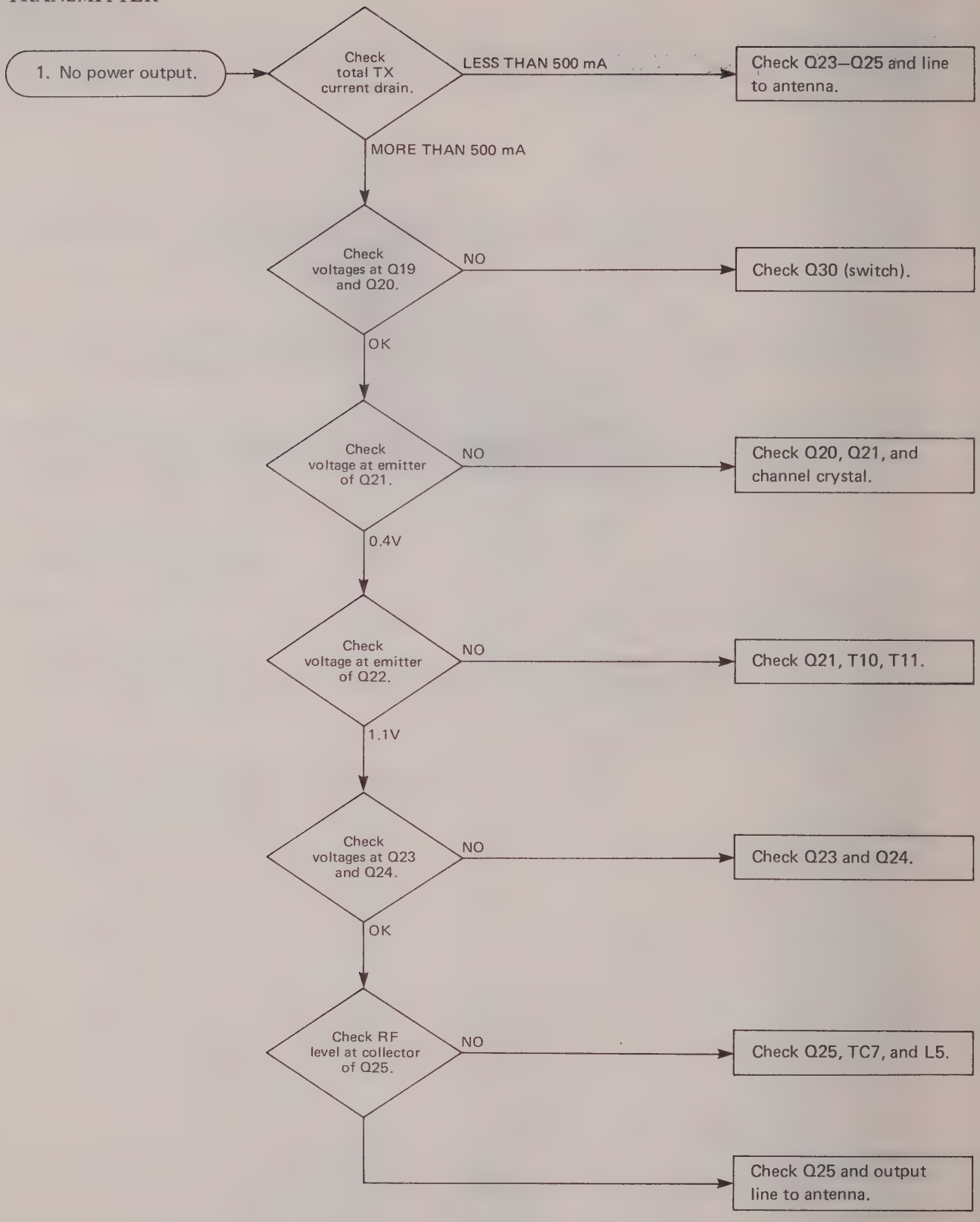
RECEIVER

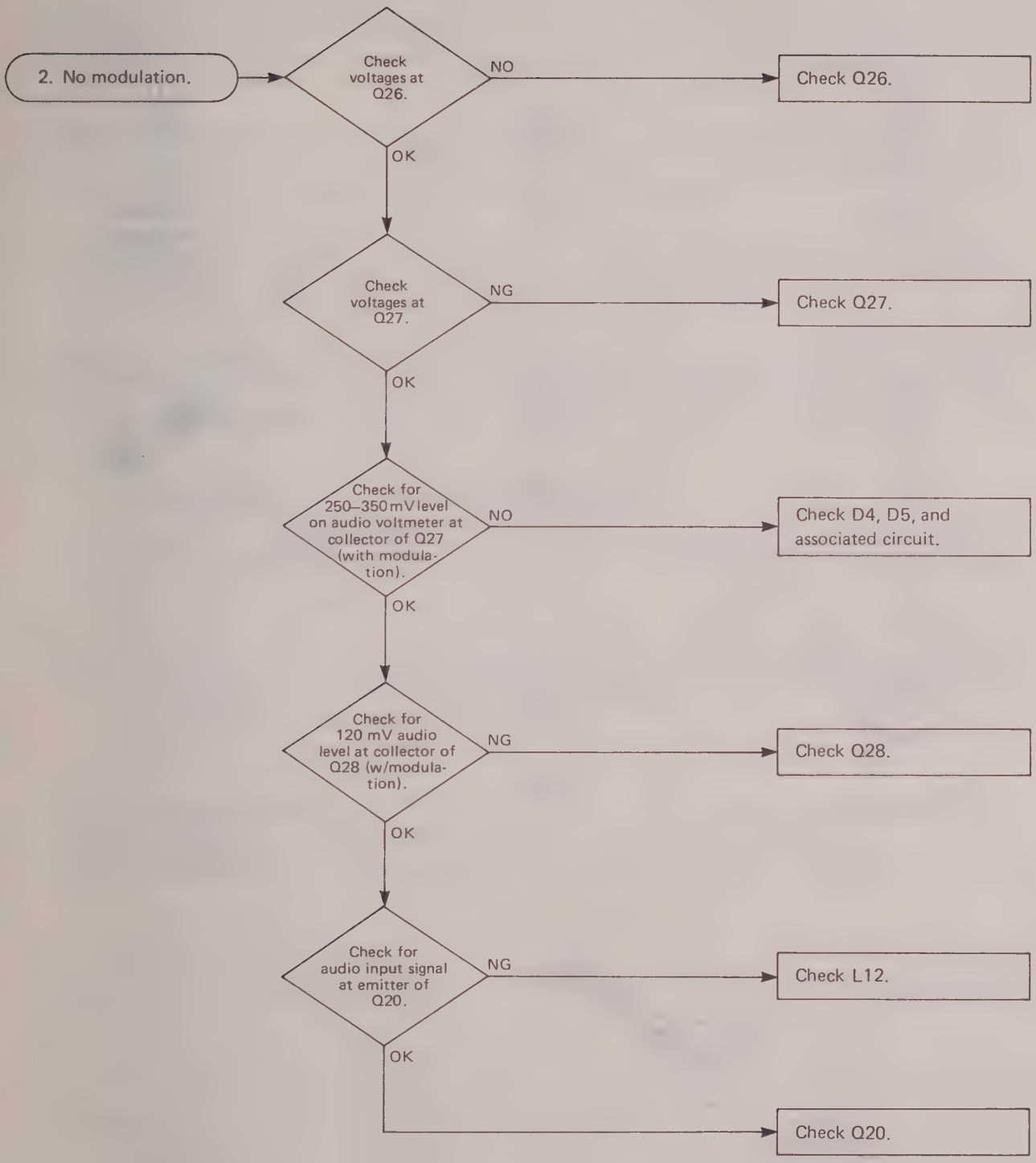
TROUBLESHOOTING


1. Power switch on, nothing happens.
With POWER switch off, is voltage present at the switch?
NO
Check battery, battery contacts, and D501/D502.
10.8V
When POWER switch is turned on, is power applied to transceiver?
NG
Check for short in 10.8V line.
OK
Check 10.8 volt line past the POWER switch.
2. No audio output.
Is there a "click" when POWER switch is turned on?
NO
Check speaker/spkr line, check Q17 and Q18.
YES
Check base voltage of Q15.
0V
Check squelch circuit and Q14.
H LEVEL
Check level setting at VR501; check discriminator.
3. No squelch action.
Check noise level at base of Q12.
NO NOISE
Adjust VR502; check Q9, R47, C56.
OK
Check noise level at base of Q13.
NO NOISE
Check Q12 and associated circuit.
OK
Check DC level at base of Q14.
LOW
Check Q13 and associated circuit.
HIGH
Check Q14.

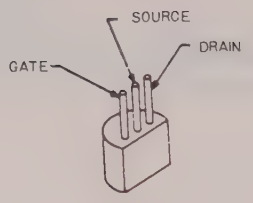

4. Poor sensitivity or no RX.
Apply 50 dB 455 kHz signal to drain of Q4. Is RX OK?
NO
Check CF1, apply 455 kHz signal (base-collector) at Q5–Q9 to find defective part.
OK
Apply 5 dB 10.7 MHz signal to drain of Q4. Is RX OK?
Check for 0.8V RF level at emitter of Q11.
NG
Check Q11 and associated circuit.
OK
OK
Check Q4, C21, and associated circuit.
Apply 20 dB RX channel freq. signal to gate of Q2. Is RX OK?
NG
Check for 50–100 mV LO level at source of Q2.
OK
Check Q2.
OK
NG
Check Q10, channel crystals, and associated circuit.
Apply 0 dB signal on channel freq. to gate of Q1. Is RX OK?
NG
Check Q1 and associated circuit.
OK
Check D1 and line to Q1.

TRANSMITTER

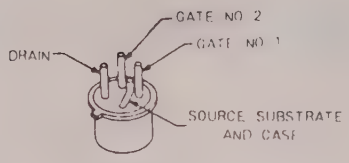



2. No modulation.
Check voltages at Q26.
NO
Check Q26.
OK
Check voltages at Q27.
NG
Check Q27.
OK
Check for 250–350 mV level on audio voltmeter at collector of Q27 (with modulation).
NO
Check D4, D5, and associated circuit.
OK
Check for 120 mV audio level at collector of Q28 (w/modulation).
NG
Check Q28.
OK
Check for audio input signal at emitter of Q20.
NG
Check L12.
OK
Check Q20.

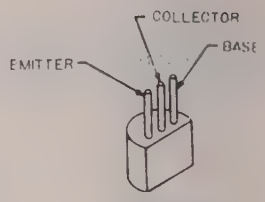
TRANSISTOR & IC CONNECTIONS



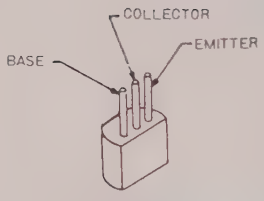
JF1033



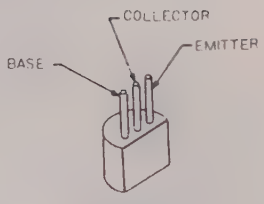
3SK51



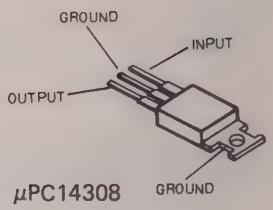
2SA695D
2SC710D
2SC1209D



2SC1311



2SC1815Y
2SC1923(O)



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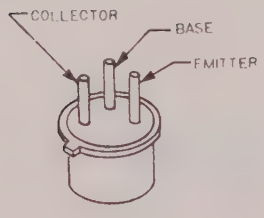

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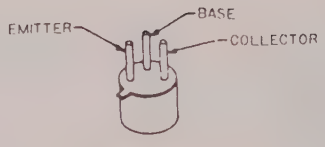

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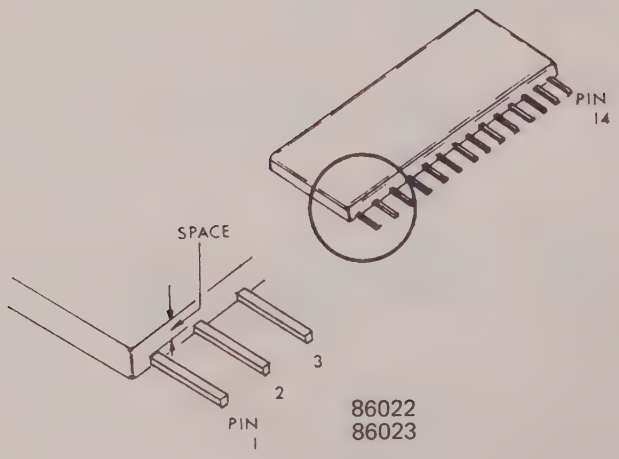

86022
86023

PARTS LIST AND ORDERING DATA

If you live in the United States, you may order parts from Yaesu Electronics Corporation. In other countries, you should order parts from the Yaesu agent for your country. In countries where Yaesu is not currently represented, you may order spare parts directly from Yaesu Musen Company, Ltd. in Tokyo.

When ordering, please specify the exact model number of the transceiver that the part is for. Many parts are standard, such as resistors and disc ceramic capacitors, but you should use particular care when ordering such items as electrolytics, tantalum capacitors, and the like.

The parts list to follow identifies the board that the parts belong to, as well as the circuit designation and part description. A "Part Number" is also specified, and this number will allow immediate identification by our parts department of the item you require. (**See note below.)

Shipment of parts from Yaesu USA is usually made by UPS, COD. Allow at least a week for the parts department to process your order. You will receive prompt notification that your order has been received, and if parts are back ordered, or if additional information is required, you will be so informed.

PARTS ORDER EXAMPLE

QUANTITY	TRANSCEIVER IDENTIFICATION	LOCATION	**PART NUMBER	CIRCUIT DESIGNATION
1	FTC-2003	PB-1988	G4800510C	Q1 (3SK51-03)

**Note: In earlier transceivers, no part numbering system was used in the manual. For this reason, the nomenclature "3SK51" will suffice for the part number. All FTC-2003 transceivers have a part number for each component.

(cut here)

YAESU MUSEN COMPANY, LTD. – C.P.O. BOX 1500, TOKYO, JAPAN
YAESU ELECTRONICS CORPORATION – P.O. Box 498, Paramount, CA 90723
YAESU ELECTRONICS CORPORATION - 9812 Princeton-Glendale Rd., Cincinnati, OH 45246

ORDER BLANK

QUANTITY	TRANSCEIVER IDENTIFICATION	LOCATION	PART NUMBER	CIRCUIT DESIGNATION

I authorize shipment via: ☐ Best Way ☐ Parcel Post ☐ UPS ☐ Other

Ship To: (Print or Type)
Name: _____
Address: _____
City: _____ State: _____ Zip: _____
Country: _____

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☐ UPS ☐ Other

Ship To:
(Print or Type)
Name: _____
Address: _____
City: _____ State: _____ Zip: _____
Country: _____

PARTS LIST

MAIN CHASSIS

Symbol No.	Parts No.	Description
		DIODE
D401,402	G2090032	Silicon Diode 1N4002
		POTENTIOMETER
VR401(S403)	J60800028	V12M4-1(6x5)S15SB5kΩ 5kΩB
VR402(S404)	J60800032	V12M4-1(6x5)S15SA20kΩ 20kΩA
		CAPACITOR
C401,402	K00179032	Ceramic 50WV SL 15pF
		INDUCTOR
L401	L0020334	
		SPEAKER
SP401	M4090026	VS-50-P 8Ω, 0.5W D=50mm
		SWITCH
S401(3CH)	N0190027	MR-3-3
(6CH)	N0190017A	BQ919-00805C
		MICROPHONE
MC401	M3290001	EM-76
		CONNECTOR P1090191
J401	~~P1090050~~	UG-625B/U
J402	P1090051	SG8512
J403	P1090052	SR30-10R-6S

MAIN UNIT

Symbol No.	Parts No.	Description
PB-1988	F0001988	Printed Circuit Board
	C0019880	PCB with components (without CRYSTAL)
		IC, FET & TRANSISTOR
Q2,4	G3090020	FET JF1033-B
Q1	G4800510C	" 3SK51-03
Q13,16,18,30	G3106950D	Tr 2SA695D
Q22,23	G3307100D	" 2SC710D
Q17,29	G3312090D	" 2SC1209D
Q6~9,11,12, 14,15,26~28	G3313110E	" 2SC1311-E
Q19,20	G3318150Y	" 2SC1815-Y
Q3,5,10,21	G3319230O	" 2SC1923-O
Q25	G3090001	" MRF-237
Q24	G3090013	" MRF-515
		DIODE
D2,3	G2001880F	Germanium 1S188FM
D4,5,7	G2015550	Silicon Diode 1S1555
D1	G2090033	" " MI301
D6	G2090025	Zener Diode WZ050

Th1	G9090002	**THERMISTOR** D-22A
		CRYSTAL
X1,2,3		HC-25/U (See page 2–3)
X4,5,9		" (")
X13	H0100720	HC-18/U 10.245MHz
		MONOLITHIC FILTER
XF1	H1101970	FMT-15A
		CERAMIC FILTER
CF1	H3900070	LF-C12
		CERAMIC DISCR
CD1	H7900010	455D
		RESISTOR
R98	J10216331	Carbon Composition 1/8W GK 330Ω
R57,58	J10246229	" " 1/4W GK 2.2Ω
R59	J10246100	" " " 10Ω
R6,31,73,76	J10246220	" " " 22Ω
R14,74	J10246390	" " " 39Ω
R9,13,35,39, 53,64,70~72, 75	J10246101	" " " 100Ω
R54,4	J10246121	" " " 120Ω
R40,91	J10246221	" " " 220Ω
R62,98	J10246331	" " " 330Ω
R12,88,94	J10246471	" " " 470Ω
R34	J10246561	" " " 560Ω
R55	J10246681	" " " 680Ω
R2,66,67,92,93	J10246102	" " " 1kΩ
R16,17,79,81	J10246152	" " " 1.5kΩ
R83	J10246182	" " " 1.8kΩ
R1,37,47,51, 90,97	J10246222	" " " 2.2kΩ
R8,15,52,78	J10246332	" " " 3.3kΩ
R27	J10246392	" " " 3.9kΩ
R20,21,24,25, 63,87	J10246472	" " " 4.7kΩ
R84	J10246562	" " " 5.6kΩ
R10,86	J10246682	" " " 6.8kΩ
R28~30,33,38, 42~45,60,61, 65,68,89,95	J10246103	" " " 10kΩ
R85	J10246123	" " " 12kΩ
R48	J10246183	Carbon Composition 1/4W GK 18kΩ
	J10246223	" " " 22kΩ
R3,5,32	J10246273	" " " 27kΩ
R69	J10246333	" " " 33kΩ
R46,80,82,11	J10246473	" " " 47kΩ
R18,19,22,23, 49	J10246563	" " " 56kΩ
R77	J10246104	" " " 100kΩ
R26	J10246154	" " " 150kΩ
R36,41,50	J10246224	" " " 220kΩ

		CAPACITOR							
C5,11,42	K00179024	Ceramic	50WV	SL	1pF	C65	K70107107	Tantalum	10WV 100μF
C92,97	K00179025	"	"	"	2pF	C44,54,59,84, 104,113~117, 122,128	K70127475	"	16WV 4.7μF
C88	K00179039	"	"	"	2pF				
C21	K00179027	"	"	"	5pF	C50,52,55	K70127106	"	" 10μF
C12	K00179028	"	"	"	7pF	C62	K70127226	"	" 22μF
C6,10	K00179029	"	"	"	8pF	C60,66,124	K70127476	"	" 47μF
C99	K00179031	"	"	"	10pF	C57,143	K70147105	"	25WV 1.0μF
C2,29,110	K00179032	"	"	"	15pF	C53,111,126	K70167104	"	35WV 0.1μF
C141	K00179033	"	"	"	22pF	C83,118,120	K70167154	"	" 0.15μF
C13,109	K00179034	"	"	"	33pF				
C78,85	K00179038	"	"	"	47pF				
C80,81	K00179036	"	"	"	100pF			TRIMMER CAPACITOR	
C23,25	K00179037	"	"	"	22pF	TC1~11	K91000029	ECV-1ZW 20x53N	20pF
C45	K02179038	"	"	CH	7pF				
C41	K02179039	"	"	"	8pF				
C142	K02179040	"	"	"	15pF			INDUCTOR	
C93	K02179034	"	"	"	22pF	L1	L1190028	FL-5H391K	390μH
C91	K02179035	"	"	"	33pF	L2,3	L0020336		
C87,89	K02179041	"	"	"	39pF	L4	L0020423		
C47,48	K02179036	"	"	"	47pF	L5	L0020337		
C34~36	K02179042	"	"	"	56pF	L6	L0020426	(R76)	
C39	K02179037	"	"	"	68pF	L7	L0020339	(R77)	
C40,77	K04179001	"	"	PG	150pF	L8	L0020340		
C133	K03179001	"	"	TH	10pF	L9	L0020341		
C67~72	K06179024	"	"	UJ	68pF	L10,11	L0020342		
C76	K06179022	"	"	"	220pF	L12	L1190074	8RB	36mH
C1,27,28,31,32, 112,119,138	K10179003	"	"	B	470pF		L9190016	Shield Case	
C24	K10179005	"	"	"	470pF				
C3,8,9,63,64, 75,100,103, 121,137,140	K10179001	"	"	"	0.001μF			TRANSFORMER	
						T1~4	L0020429		
						T5~7	L0190001	85PC-2874A	
C7	K10179004	"	"	"	0.001μF	T8	L0020344		
C17,30,38,43, 56,79,82,86, 90,94,96,123, 127	K13179001	"	"	F	0.01μF	T9	L0020345		
						T10	L0020346		
						T11	L0020347		
						T12	L0020343		
C15,18,19,22, 26,49	K13179004	"	"	"	0.01μF	T13	L0020348		
C46,58,139	K13179002	"	"	"	0.022μF				
C51,125	K13179005	"	"	"	0.022μF			SWITCH	
C95 *1	K02179030	"	"	CH	33pF	S1	N7090003	Micro Switch	AH2504H25
*2	K02179029	"	"	"	27pF				
*3	K02179043	"	"	"	22pF		B4047910A	Heat Sink	
C98 *1	K02179044	"	"	"	27pF		B4052990	X-tal Socket	
*2	K02179034	"	"	"	22pF				
*3	K02179040	"	"	"	15pF				
C102 *1	K00179040	"	"	SL	27pF	BUSY, LED UNIT			
*2	K00179033	"	"	"	22pF	Symbol No.	Parts No.	Description	
*3	K00179032	"	"	"	15pF	PB-1992(LED)	F0001992	Printed Circuit Board	
C105 *1	K00179041	"	"	"	39pF	PB-1993(BUSY)	F0001993	" " "	(3CH)
*2	K00179041	"	"	"	39pF	PB-2091(")	F0002091	" " "	(6CH)
*3	K00179034	"	"	"	33pF		C0019920	PCB with components	
C106 *1	K00179041	"	"	"	39pF		C0019930	" "	
*2	K00179034	"	"	"	33pF		C0020910	" "	(without CRYSTAL)
*3	K00179034	"	"	"	33pF			TRANSISTOR	
C144 *1	K00179026	"	"	"	3pF	Q301~303	G3313110E	Silicon Transistor	2SC1311E
*2		Not used						DIODE	
*3		"	"			D301,302	G2015550	Silicon Diode	1S1555
		*1 134~154 MHz				D303	G2090007	Zener Diode	WZ061
		*2 142~164 MHz				D304,305	G2090080	LED	LN28RP
		*3 152~174 MHz							
C61	K50177332	Mylar Film	50WV		0.0033μF			CRYSTAL	
C33	K50177333				0.033μF	X301~303		HC-25/U (See page 2–3)	

		RESISTOR	
R306	J10246561	Carbon Composition	1/4W GK 560Ω
R303	J10246152	" " "	1.5kΩ
R302,304	J10246103	" " "	10kΩ
R305	J10246223	" " "	22kΩ
R301	J10246473	" " "	47kΩ
		POTENTIOMETER	
VR301	J51713102	EVN-A0A-A00B13	1kΩB
		CAPACITOR	
C301	K70167104	Tnatalum 35WV	0.1μF

ACCESSORIES

Symbol No.	Parts No.	Description
ANT		Antenna FHA-1(A-E) (See page 1–3)
		Battery pack NFB-1
		Shoulder strap

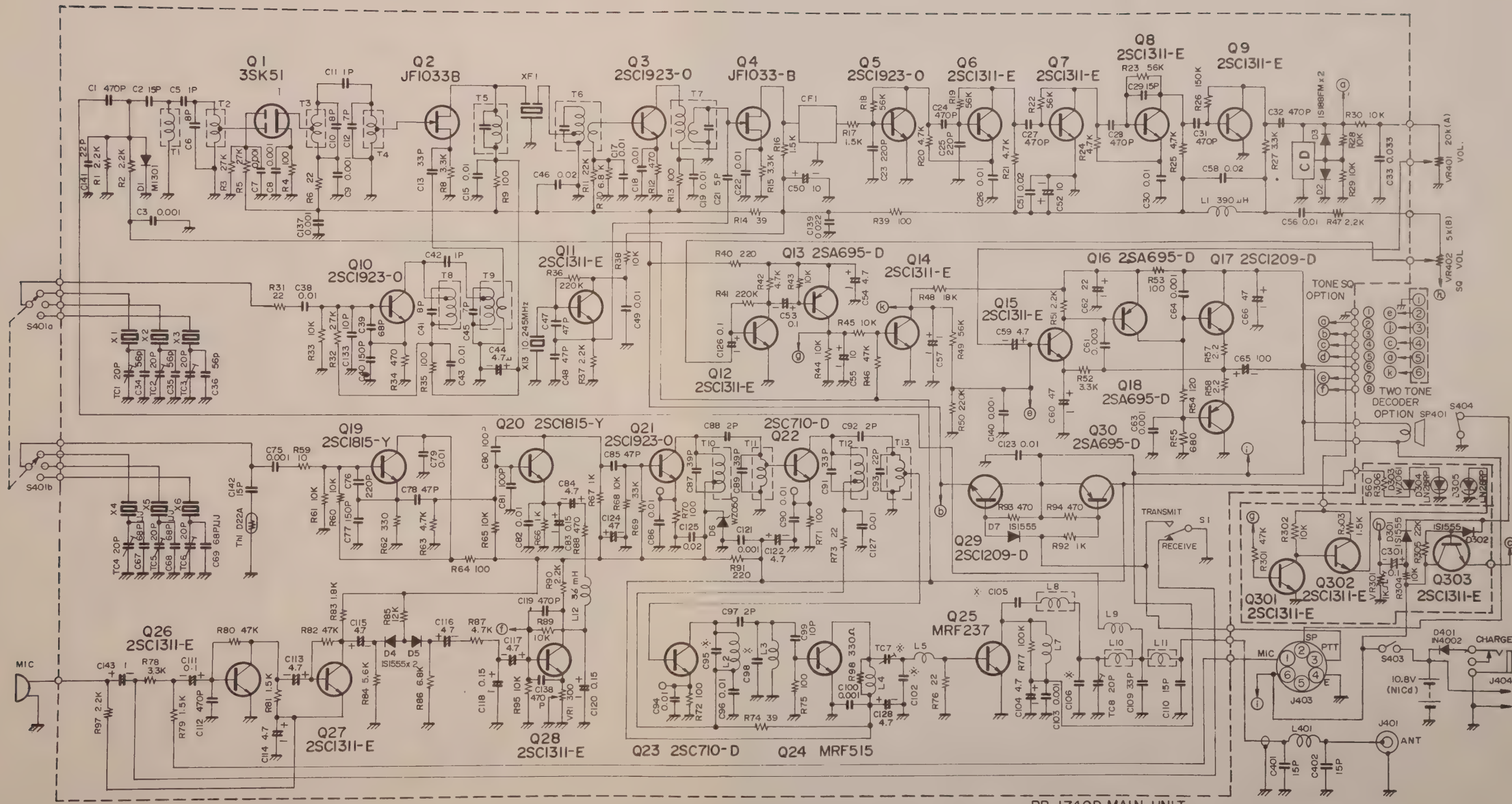
TONE SQUELCH UNIT (OPTION)

Symbol No.	Parts No.	Description
PB-1999	F0001999	PCB with components
	C0019990	(without Q501,R502)
		IC & TRANSISTOR
Q501	G1090178	IC 86022
Q502,503	G3313110E	Tr 2SC1311E
		DIODE
D501	G2090042	Zener RD-8.2EB
		RESISTOR
R505	J10246221	Carbon Composition 1/4W GK 220Ω
R504,506	J10246103	" " " 10kΩ
R501	J10246473	" " " 47kΩ
		TUNING RESISTOR
R502		
*1 (67.0Hz)	J20249035	Carbon Composition 1/4W 165kΩ ±1%
*2 (71.9Hz)	J20249032	" " " 143kΩ "
*3 (74.4Hz)	J20249030	" " " 133kΩ "
*4 (77.0Hz)	J20249028	" " " 124kΩ "
*5 (79.7Hz)	J20249026	" " " 118kΩ "
*6 (81.0Hz)	J20249025	" " " 113kΩ "
*7 (82.5Hz)	J20249024	" " " 110kΩ "
*8 (85.4Hz)	J20249022	" " " 102kΩ "
*9 (88.5Hz)	J20249020	" " " 95.3kΩ "
*10 (90.0Hz)	J20249019	" " " 93.1kΩ "
*11 (91.5Hz)	J20249018	" " " 88.7kΩ "
*12 (94.8Hz)	J20249016	" " " 84.5kΩ "
*13 (100.0Hz)	J20249014	" " " 75.0kΩ "
*14 (103.5Hz)	J20249013	" " " 71.5kΩ "
*15 (107.2Hz)	J20249010	" " " 64.9kΩ "
*16 (110.9Hz)	J20249008	" " " 60.4kΩ "
*17 (114.8Hz)	J20249006	" " " 56.2kΩ "
*18 (118.8Hz)	J20249004	" " " 52.3kΩ "
*19 (123.0Hz)	J20249002	" " " 49.9kΩ "
*20 (127.3Hz)	J20249037	" " " 182kΩ "
*21 (131.8Hz)	J20249036	" " " 169kΩ "
*22 (136.5Hz)	J20249034	Carbon Composition 1/4W 158kΩ ±1%
*23 (141.3Hz)	J20249033	" " " 150kΩ "
*24 (146.2Hz)	J20249031	" " " 137kΩ "
*25 (151.4Hz)	J20249029	" " " 130kΩ "
*26 (156.7Hz)	J20249027	" " " 121kΩ "
*27 (162.2Hz)	J20249025	" " " 113kΩ "
*28 (167.9Hz)	J20249023	" " " 105kΩ "
*29 (169.0Hz)	J20249023	" " " " "
*30 (173.8Hz)	J20249021	" " " 97.6kΩ "
*31 (179.9Hz)	J20249019	" " " 93.1kΩ "
*40 (186.2Hz)	J20249017	" " " 86.6kΩ "
*41 (188.0Hz)	J20249016	" " " 84.5kΩ "
*42 (192.8Hz)	J20249015	" " " 80.6kΩ "
*43 (203.5Hz)	J20249013	" " " 71.5kΩ "
*44 (209.0Hz)	J20249012	" " " 68.1kΩ "
*45 (210.7Hz)	J20249011	" " " 66.5kΩ "
*46 (218.1Hz)	J20249009	" " " 63.4kΩ "
*47 (225.7Hz)	J20249007	" " " 59.0kΩ "
*48 (233.6Hz)	J20249005	" " " 54.6kΩ "
*49 (241.8Hz)	J20249003	" " " 51.1kΩ "
*50 (250.3Hz)	J20249001	" " " 47.5kΩ "
		See page 2–5
		POTENTIOMETER
VR501	J50724103	PN822H 103V 10kΩB
VR503	J50724503	PN822H 503V 50kΩB
VR502		
*A (67.0Hz ~ 90.0Hz)	J50724203	PN822H 203V 20kΩB
*B (91.5Hz ~ 123.0Hz)	J50724103	PN822H 103V 10kΩB
*C (127.3Hz ~ 179.9Hz)	J50724203	PN822H 203V 20kΩB
		CAPACITOR
C505~509	K10179001	Ceramic disk 50WV 0.001μF B
C504	K70127475	Tantalum 16WV 4.7μF
C501~503	K70127106	" " 10μF
		MINIATURE SOCKET
	P1090093	2-331272-5
	R7053250	Cushion

TWO TONE DECODER UNIT (OPTION)

Symbol No.	Parts No.	Description
PB-2090	F0002090	Printed circuit board
	C0020900	PCB with components (without Q601, R601~R604)
		IC & TRANSISTOR
Q601	G1090250	IC 86023
Q602~608	G3313110D	Tr 2SC1311D
		DIODE
D601	G2090042	Zener RD8.2EB
		RESISTOR
R609	J10246221	Carbon Composition 1/4W GK 220Ω
R606,607	J10246103	" " " " 10kΩ
R612,615	J10216103	" " 1/8W " 10kΩ
R605	J10246333	" " 1/4W " 33kΩ

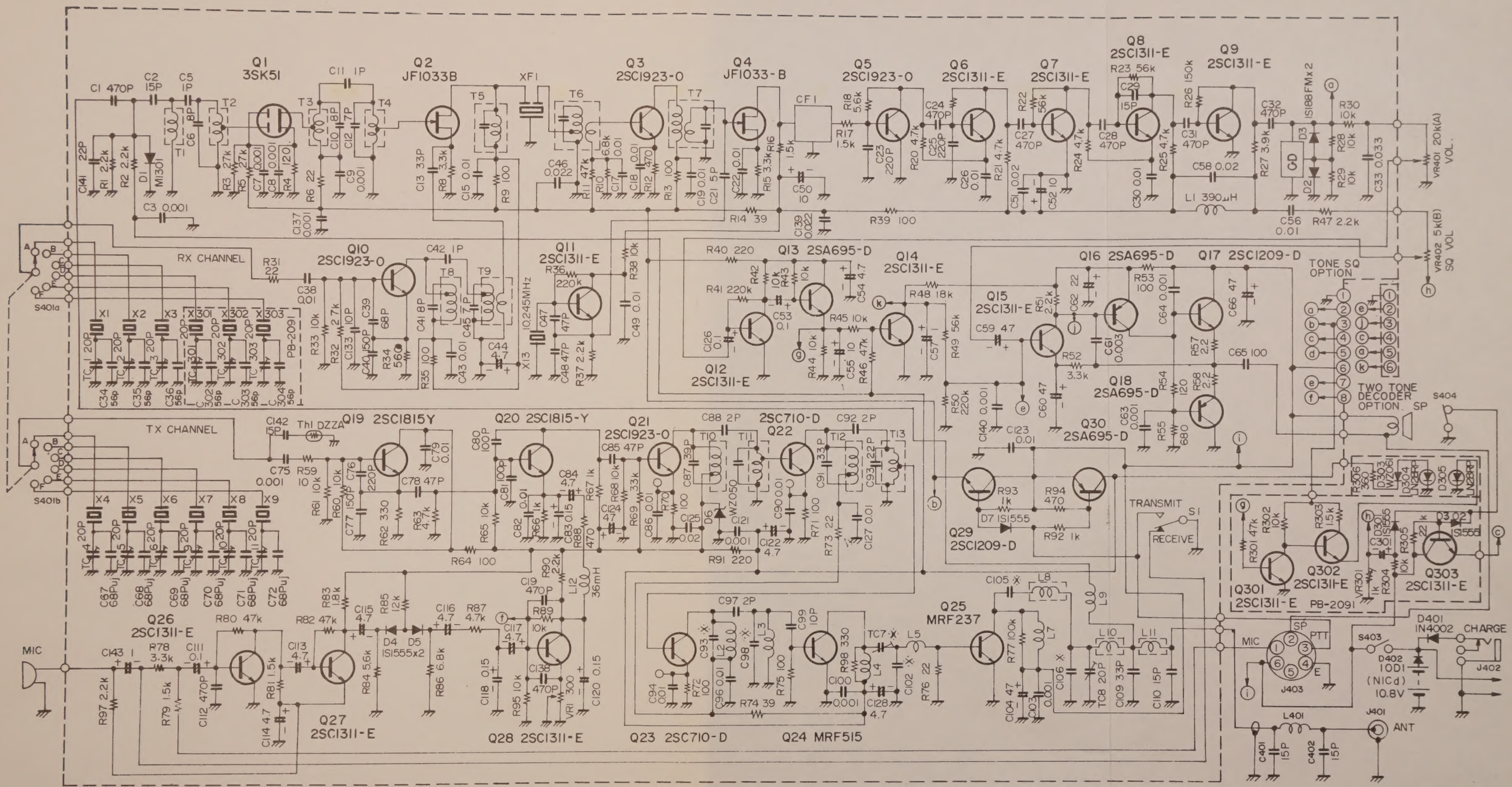
R608,610,611	J10246683	Carbon Composition			
		1/4W GK	68kΩ		
R613,614	J10216334	" " 1/8W	" 330kΩ		
		TUNING RESISTOR			
		See page 2–7			
		POTENTIOMETER			
VR602	J50707103	PN822H	103V 10kΩB		
VR601	J50707503	PN822H	503V 50kΩB		
		CAPACITOR			
C602	K12171102	Ceramic	50WV 0.001μF		
C604,605	K50177102	Mylar	" 0.001μF		
C601,606	K70167105	Tantalum	16WV 1μF		
C603	K70127106	"	" 10μF		
		IC SOCKET			
QS601	P3090035	116-28-30-114 (1/2)			
		MINIATURE SOCKET			
	P1090093	2-331272-5			



	C95	C98	C102	C105	C106	TC7
A. 134 ~ 154MHz	33P	27P	27P	39P	39P	20P+ 3P(C144)
B. 142 ~ 164MHz	27P	22P	22P	39P	33P	20P
C. 152 ~ 174MHz	22P	15P	15P	33P	33P	20P

NOTES
1. ALL FIXED RESISTORS IN Ω 1/4W UNLESS OTHERWISE NOTED
2. ALL CAPACITORS IN μF UNLESS OTHERWISE NOTED.

FTC-2003
CIRCUIT DIAGRAM
3 Channel Model



	C95	C98	C102	C105	C106	TC7
A 134 ~ 154MHz	33P	27P	27P	39P	39P	20P + 3P(C144
B 142 ~ 164MHz	27P	22P	22P	39P	33P	20P
C 152 ~ 174MHz	22P	15P	15P	33P	33P	20P

NOTES

1. ALL FIXED RESISTORS IN Ω 1/4W UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS IN μF UNLESS OTHERWISE NOTED.

FTC-2003
CIRCUIT DIAGRAM

6 Channel Model

YAESU

94117